





ANIMAL KINGDOM

NEW YORK ZOOLOGICAL SOCIETY



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Numbers 1-6

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ANNUAL KINGDOM
NEW YORK ZOOLOGICAL SOCIETY



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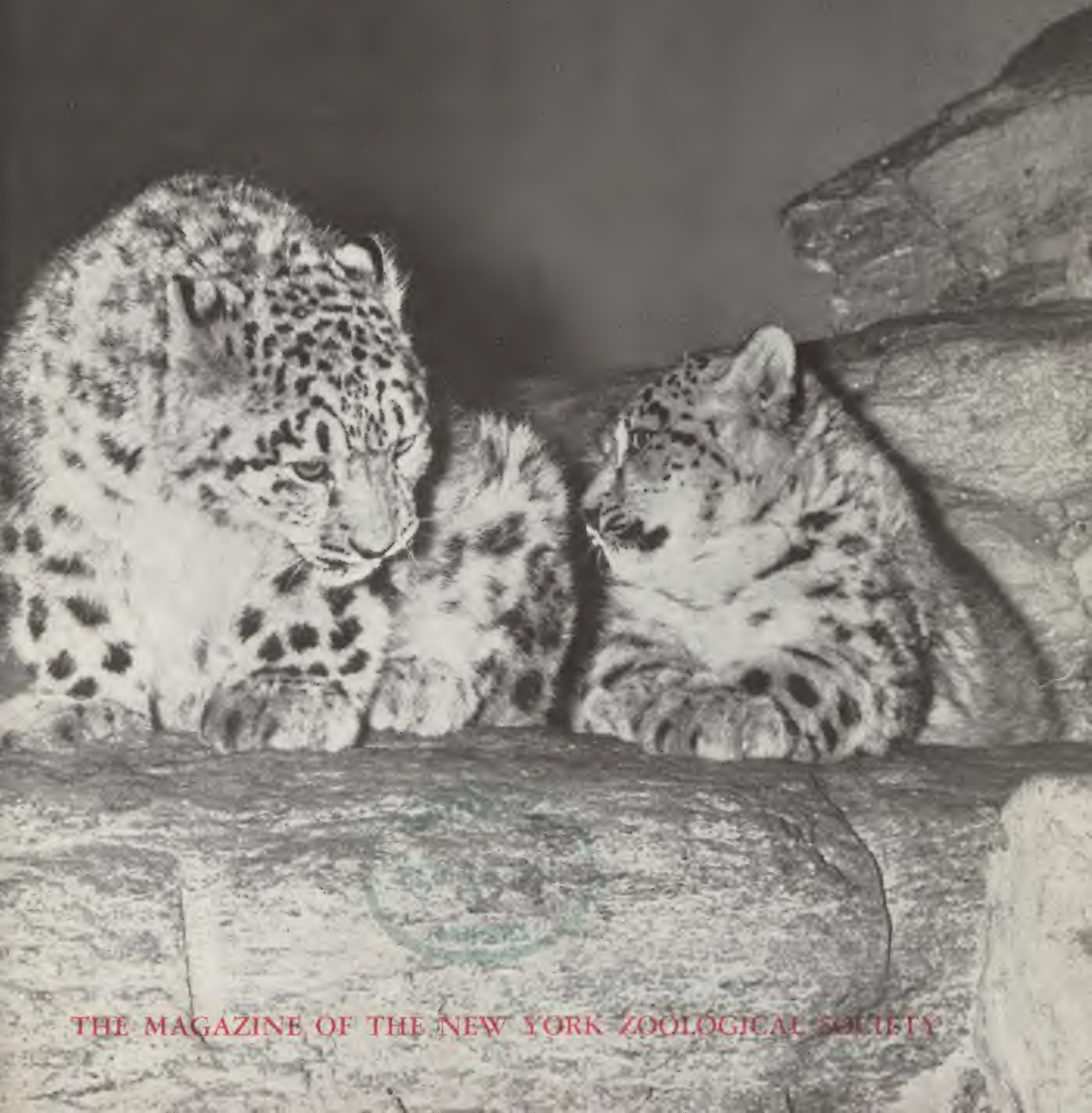
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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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The Unity of Living Things

OCCASIONALLY ONE HAS AN EXPERIENCE that has the aspects of a revelation. The one described below occurred early last year in Africa while camping out in the Mara region, north of the Serengeti Plains in Kenya.

This is a remote area, far from any human habitation, and not even entered by the Masai or their cattle, because it is tsetse fly country which could give the dreaded nagana disease to the cattle or, alternately, sleeping sickness to themselves. This region is one of the few last paradises for wild animals still existing in that vast continent. They were all there — elephants, rhinos, lions, leopards, giraffes, zebras, and a great variety of antelopes and gazelles. Of course the predators were preying upon their quarry, especially at dusk or dawn, and yet there seemed to be no fear or strife. Frequently we saw a pride of lions resting in midday under the shade of an acacia tree, with herds of antelope barely more than a stone's throw away, grazing quietly. A toll would be taken from them on the morrow as it had been "yesterday," and yet there was no fear — a symbolic scene — a unity of living things, the natural order of life and death without fear.

Fairfield Osborn

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Dr. Hornaday Had
Some Words for Them—

TWO YOUNG SNOW LEOPARDS IN THE ZOO

By WILLIAM BRIDGES
Curator of Publications

A FEW WEEKS AGO we carried two gentle young Snow Leopards from the Animal Hospital to their new home in one of the outside bays of the Lion House. For more than a month they had submitted to dosing for parasites, to injections for feline distemper and pneumonia, to repeated handling and close observation, and through it all their equanimity never deserted them. A few throaty growls, perhaps, and a wrinkling of the lips when a stranger came close, but those were for show; a Snow Leopard, after all, has to prove that he is a leopard and not a tabby-cat.

Watching the uneventful transfer from Hospital quarantine to exhibition, someone recalled Dr. William T. Hornaday's capsule characterization of the Snow Leopard.

"The snow leopard," Dr. Hornaday wrote in "Minds and Manners of Wild Animals" in 1922, "is sanguine, optimistic and peace-loving."



Charles R. Knight's painting of a Snow Leopard from the collection of the Zoological Society.

Well not always peace-loving perhaps, but rarely as uncompromisingly hostile as, say, the average Black Leopard. Feeling as he did about the temperament and innate harmlessness of *Panthera uncia*, Dr. Hornaday's wrath at the fate of our first specimen is understandable.

A brown and brittle clipping from the *New York Herald* of fifty-six years ago, preserved in a scrapbook that Dr. Hornaday himself probably pasted up, gives some hint of the story, and its outlines can be pieced together from a laconic entry on a record card in our Mammal Department's files and a few references in our publications.

Snow Leopards in the early years of this century were considerable zoological rarities — as, for that matter, they are still today — and the first



two pages of the Zoological Society's *Bulletin* for October, 1903, were devoted to an account of the difficulties we experienced in getting a specimen and its behavior in the Zoological Park. Mrs. Hugh D. Auchincloss, the wife of one of the Society's Trustees, had presented the animal and had paid \$900 for it, a price that was considered "costly" then, and would be a prime bargain today.

"Chang," as he was called, was apparently an ideal exhibition animal. Dr. Hornaday wrote in the *Bulletin* that "'Chang' is as good-tempered as a house-cat, and when fed is as playful as a kitten with a live mouse. Its daily ration consists of a chicken, well cleaned and plucked, offered about six o'clock, when everything is quiet.

"As soon as the food is handed in, the performance begins; and whenever the animal is given the freedom of the huge, rock-furnished cage next door, the sight is most interesting. Up

to the top of the rock dashes the Ounce [the alternative name of the Snow Leopard], until the highest point is reached. Often the chicken is thrown high into the air, and as it falls the animal leaps over it. Sometimes it is thrown or dropped over the edge of the rocks, and 'Chang' leaps after it — pretending that it is alive, and trying to escape. After the play is over, the chicken is taken to the water pan, and carefully washed before it is eaten!"

"Chang" came to the Zoological Park on August 1, 1903, at a time when only two other Snow Leopards were on exhibition elsewhere, one in London (which received its first one in 1891) and the other in the Tiergarten in Berlin. The animal was immediately put on exhibition in the bright new Lion House, opened only a few months before, and was one of the proudest possessions of the young Zoological Park, then less than five years old. Our pride was heightened in midsummer of 1904 when Mrs. Auchincloss (at a cheaper-in-quantity price of \$1,000) presented us with two more Snow Leopards, both females. For a time, but an unhappily brief time, the three animals lived together in one of the Lion House compartments.

Then, around midnight on July 31, 1904, one of the Snow Leopards escaped through the skylight. The Mammal Department's records say it was the male, "Chang"; Dr. Hornaday, in commenting on the incident in the following year's *Annual Report*, twice refers to it as one of the two females. There is no way now of knowing which version is correct, but the departmental records explicitly state later dates of death for the two Auchincloss females and give the night of July 31 for the demise of "Chang."

Did the night watchman making his rounds discover only two Snow Leopards in the compartment that had contained three the night before, or did he catch sight of a pale body slinking through the underbrush a few hundred feet from the Lion House? We will never know — but we do know that he summoned the police, and a policeman shot the Snow Leopard.

Dr. Hornaday's wrath the next morning can be imagined and savored even at this late date; he was still talking about the incident more than six months later when he blasted the New York newspapers for their "blood-curdling stories"



about happenings in the Zoological Park. As for the Snow Leopard, "that animal," he wrote, "was murdered at midnight by a conjunction of rattled men, when it might easily have been caught if anyone present had done one thing with good judgment."

For the Snow Leopard, as even a rattled policeman should have known, is "sanguine, optimistic and peace-loving"!

But all that was long ago and if any of the participants in that nocturnal leopard hunt are still alive, their scalps are perhaps no longer tender. It is more profitable to learn what hunters and naturalists have had to say about the Snow Leopard in its native Asia, as a means of putting our two lovely youngsters into perspective.

Its alternative name is Ounce, which the dictionary traces through French *once*, Spanish

onza, Portuguese *onça*, Italian *onza* and New Latin *uncia*. "Ounce" doesn't have much significance to the general visitor to the Zoological Park but "Snow Leopard" is poetically descriptive. As big cats go it is not especially impressive in sheer size; a Snow Leopard with a body 3 feet 8 inches long and a 3-foot tail is quite a big one. But its fur makes all the difference. Smoky-creamy-white, with bold, black-edged rosettes that concentrate to black spots on the legs, the fur is extremely long and soft. The tail droops and curls with what would seem to be excessive luxuriance. But in the bitter winters of the Himalayas heavy fur is no luxury.

What kind of a market exists for Snow Leopard pelts in the Far East nowadays would be hard to find out, but half a century ago there was a thriving trade in tanned skins, and 2,000 a year were said to be brought into Shanghai from the

interior of China. Many still come into the market at Darjeeling.

There are all sorts of estimates of the altitude at which the Snow Leopard roams, but 6,000 feet in winter is apparently about its lowest level and in summer it haunts the wild and broken country above tree-line at 12,000 to 13,000 feet, even to 18,000 feet. There is plenty to eat at those heights — Marco Polo's Sheep, the Argali, the Siberian Ibex, the Burrhel, rodents, even birds. A local name of the Snow Leopard east of Kumaon is *burhel haye*, or "Burrhel killer."

Unfortunately the Snow Leopard does not confine itself to wild game. Too many of the leopards find the pickings good around villages where domestic animals are at liberty and there are tales of its depredations on sheep and goats and ponies. Many of the sportsmen who have written books (and such dull ones!) on their hunting exploits in the Himalayas have recorded search for the Snow Leopard, usually without success. Lt. Col. R. W. Burton told in the *Journal of the*

Bombay Natural History Society in 1926 how he made a weary hunt for a worthy Ibex trophy, only to find that a Snow Leopard had killed a much finer animal than he had. Burton is one of the few men to record an attack by a Snow Leopard on a man. At Ramrikcha temple he met a priest whose face was scarred by a leopard.

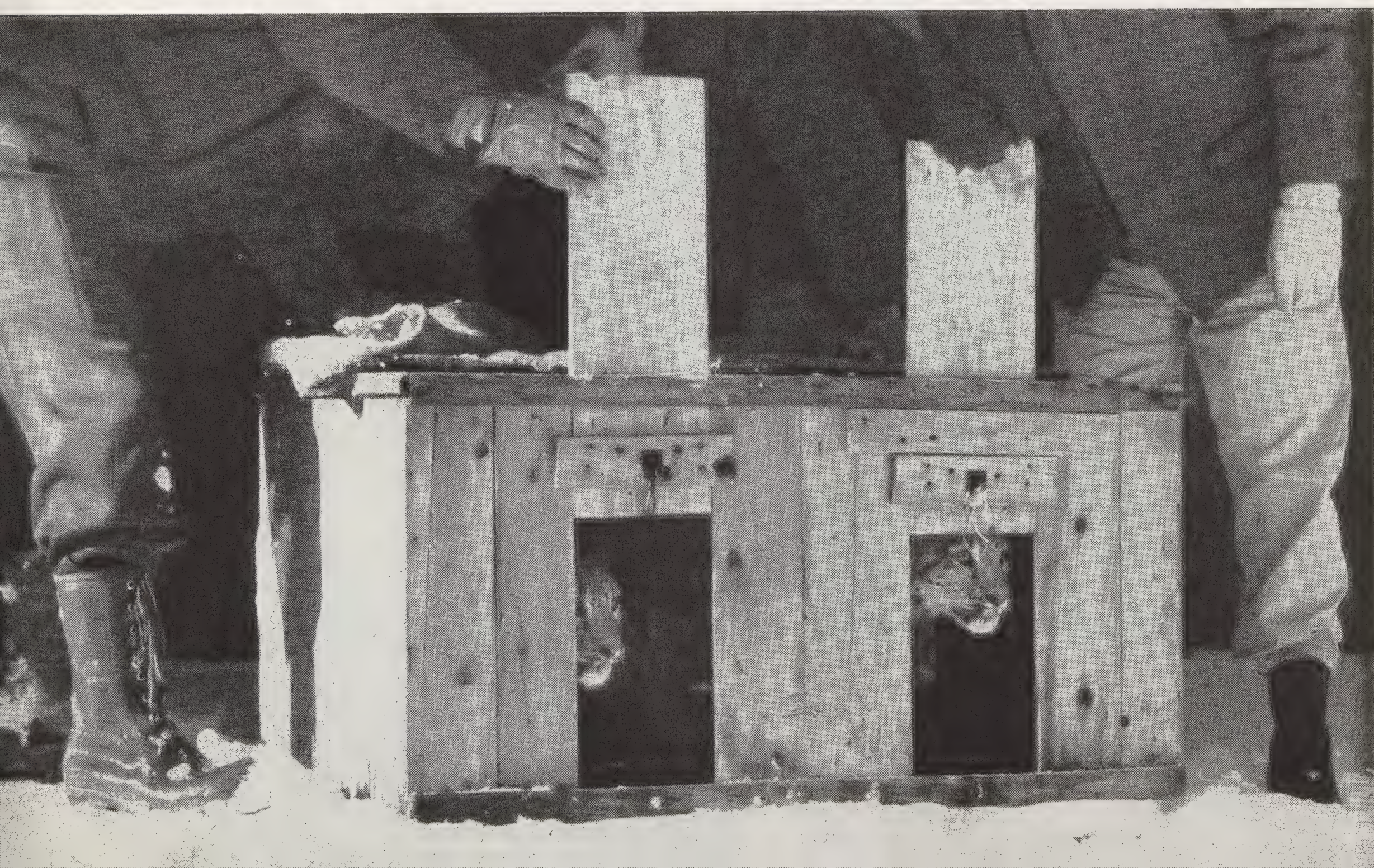
"A few years previously," he wrote, "a snow leopard got into a hut near the temple, where sheep were kept at night, and killed twenty-one of them. The next evening he was around the place again. The *poojari* [priest] saw that the murderer was after some goats so he went out to put them into a hut. The leopard apparently resented this as he went for the priest and clawed his face! The same night the leopard visited Charong village, a mile away, and attacked and clawed a woman there. The villagers decided that the animal must be killed, so tracked it to where it was lying up among some bushes about half a mile off and, surrounding the place, slew it with stones and sticks without damage to themselves. A plains panther would not have died under these circumstances without leaving his mark on a few of his assailants."

It may have been merely an indication that in earlier days guns and ammunition were not easily come at, but several accounts of Snow Leopard hunts by native peoples mention their habit of killing the animal with stones, especially when it has been trapped in a pit baited with a live kid. Indeed, many of the skins offered for

It was an appropriately cold day in December when the two Snow Leopards were moved from the Animal Hospital to a Lion House compartment.

A ring of photographers outside the bay made them hesitate to come out of the carrying crate. Eventually its whole front had to be dismantled.

Nightingale Photo—Newsday





In a few days the youngsters were accustomed to new quarters and a new keeper and were actually willing to accept food from his hand.

sale are said to have been damaged by stones showered on the leopard.

The playfulness of Snow Leopard cubs is mentioned by Col. A. E. Ward in the *Journal of the Bombay Natural History Society* for 1923 in terms reminiscent of Dr. Hornaday's report on "Chang's" behavior at feeding time in the Zoological Park. Ward put a shelf on his verandah for the cubs. "They would jump up and down, time after time, with extraordinary ease. Directly they would touch the verandah floor they would twist round and bound back on to the shelf."

Unlike modern hunters, Ward considered "game" as created only for sportsmen. "In a large enclosure with plenty of shade the Ounce would be a lovely creature to watch," he admits. "Beautiful it certainly is, but it is a most destructive game killer and should be classed as vermin."

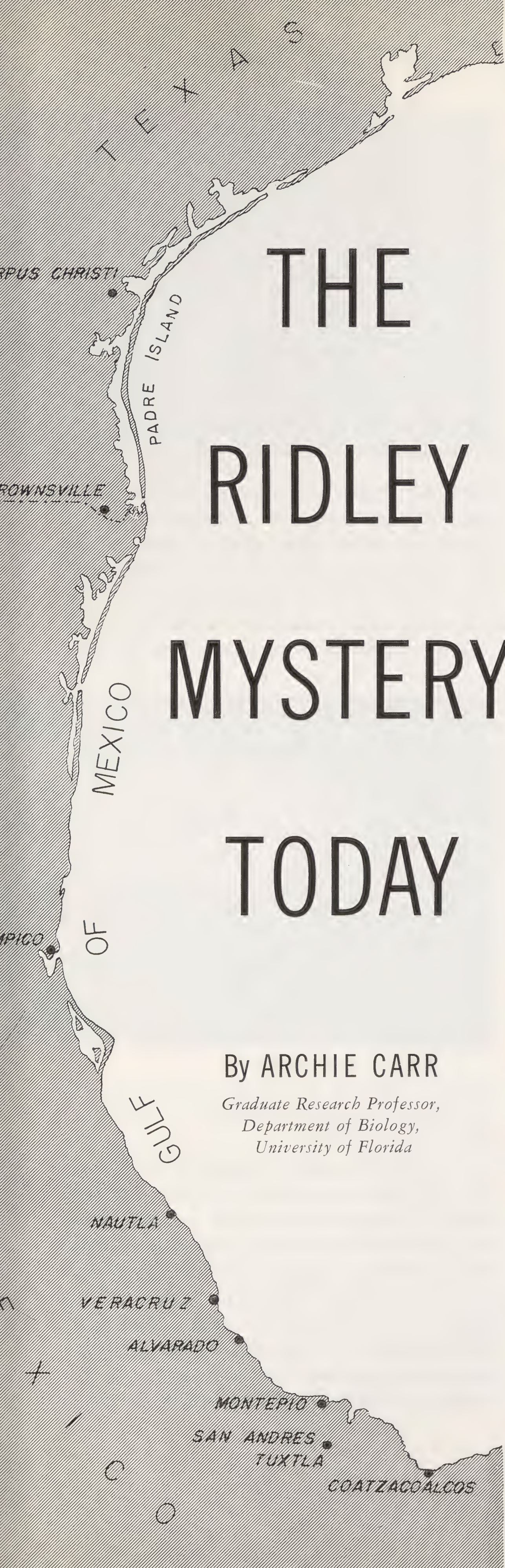
Well, our two youngsters are certainly not going to be classed as vermin. They are, we think, brother and sister, born in one of the European zoological gardens last spring. Theoretically they should produce cubs in two or three years, and

their management should be reasonably easy, for they have already grown accustomed to their keeper and visitors.

They may never, however, be as "steady" as our favorite Snow Leopard of recent years, the delightful animal known as "Bowser."

We first heard about him in the spring of 1946 when an Air Force Lieutenant wrote that while flying "The Hump" in China he had acquired "a young leopard" that had been a wonderful pet and companion to him. It rode in the airplane with him and was as tame as a kitten. Back in the United States, he had brought his pet along but had found, as so many returning service men did, that pets grow up. Would we like to buy it?

It was not clear from his letter what kind of a leopard this was, and protracted correspondence failed to settle the identification. When we asked whether "Bowser" had a light-colored body with dark rosettes, and whether its hair and tail were unusually long, all he could decide was "Well, more or less." Eventually we asked him to ship the animal to us. It was a Snow Leopard, all right, answering to the name of "Bowser" and just as gentle as its former owner said it was. "Bowser" lived with us to a ripe old age and was all that Dr. Hornaday claimed for the species: sanguine, optimistic and peace-loving.



THE RIDLEY MYSTERY TODAY

By ARCHIE CARR

Graduate Research Professor,
Department of Biology,
University of Florida

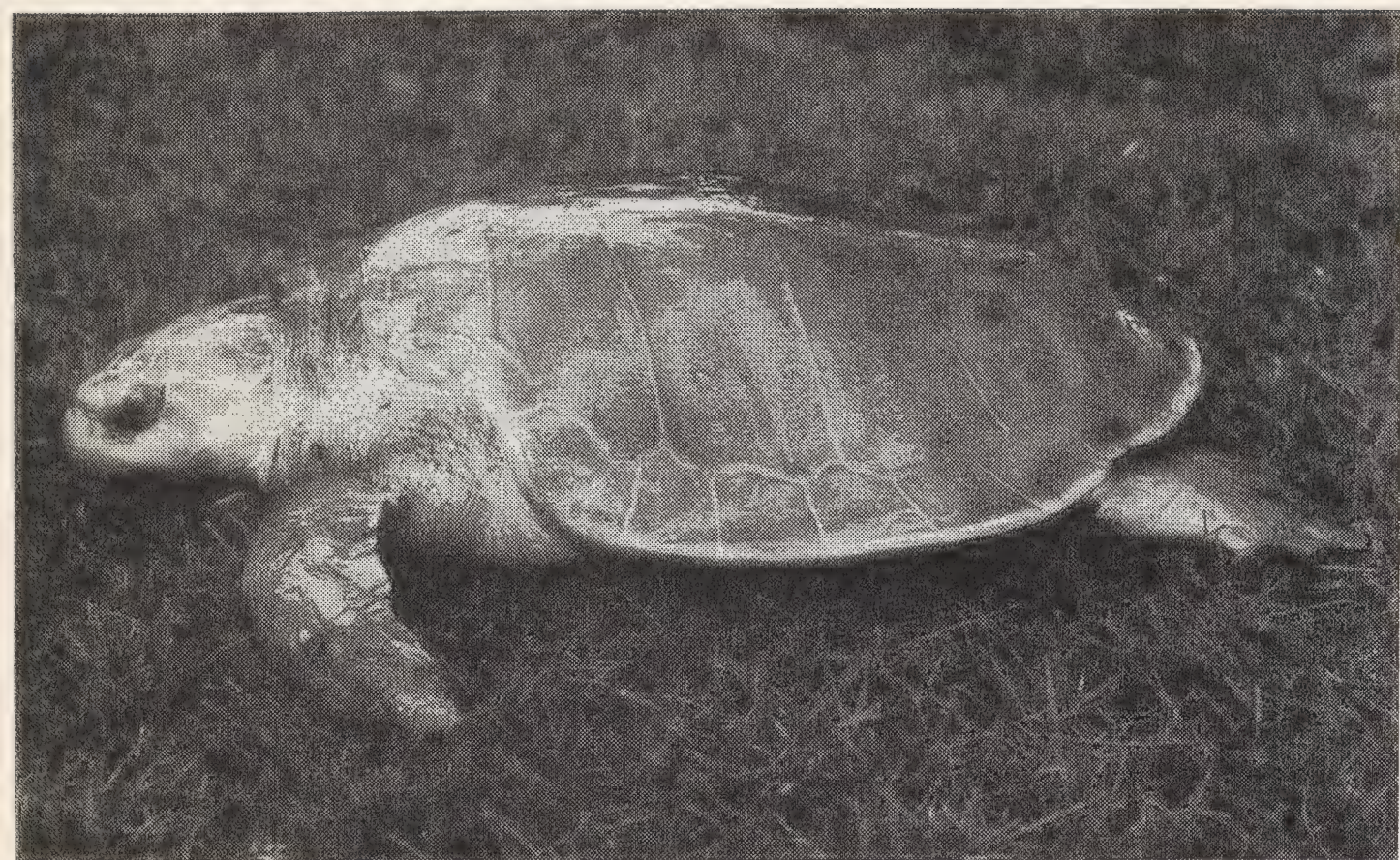
WHEN I WROTE "The Riddle of the Ridley" several years ago,* it seemed to me that the mystery this sea turtle's breeding habits would have to wait for its solution until somebody stumbled on masses of Ridleys ganged up in an overlooked place, perversely carrying out their sex rites in secret. But instead of coming in a burst of light the answer is just trickling in as time goes by. We finally know for sure that Ridleys come in two sexes. We know how big they are when they start to breed and what the hatchling looks like. Places where Ridleys go sparingly ashore to nest have been found along the Gulf coast in Veracruz, so we know they are able, at least occasionally, to reproduce their kind. The mystery has dwindled, and what remains to be done is fill in gaps and clear up stray uncertainties, and above all to learn how the skimpy nesting that goes on, in the only places it's known to go on at all, could furnish all the Ridleys that turn up in Florida and along the Atlantic coast, and on down the Gulf Stream in the British Isles.

During August and September, 1960, I made a sea turtle reconnaissance on the Pacific Coast of Mexico, travelling with my family by car from the level of Hermosillo down through Sonora and Sinaloa to San Blas in Nayarit. Partly, the trip was just an effort to learn something about the poorly known sea turtle fauna there. But a more special aim was to broaden my acquaintance with the Pacific Ridley, in the hope that this might help me understand its elusive relative in the Atlantic and Gulf of Mexico. In both ways the trip turned out to be a worth while venture, and its aftermath brought oddly coincidental developments, as I shall tell.†

It is 650 miles from Kino Bay down the coast to San Blas, part of the way along the eastern shore of the Gulf of California, part along beaches of the open Pacific. In all this territory the only turtles I found regularly were the Green (*Chelonia*) and the Ridley (*Lepidochelys*). The Trunkback and Hawksbill were known to the

* "The Riddle of the Ridley," by Archie Carr, *Animal Kingdom*, September-October, 1955.

† Field work partly supported by a National Science Foundation Grant—G-10717.



those of two *golfinas* (Ridleys) he had found nesting two weeks before when his oxen had strayed on the beach.

An observer making an aerial survey of these beaches would get the impression that they are almost completely devoid of nesting activity. The Ridley is so relatively little and light, and the sand of these shores so loose and flaky, that

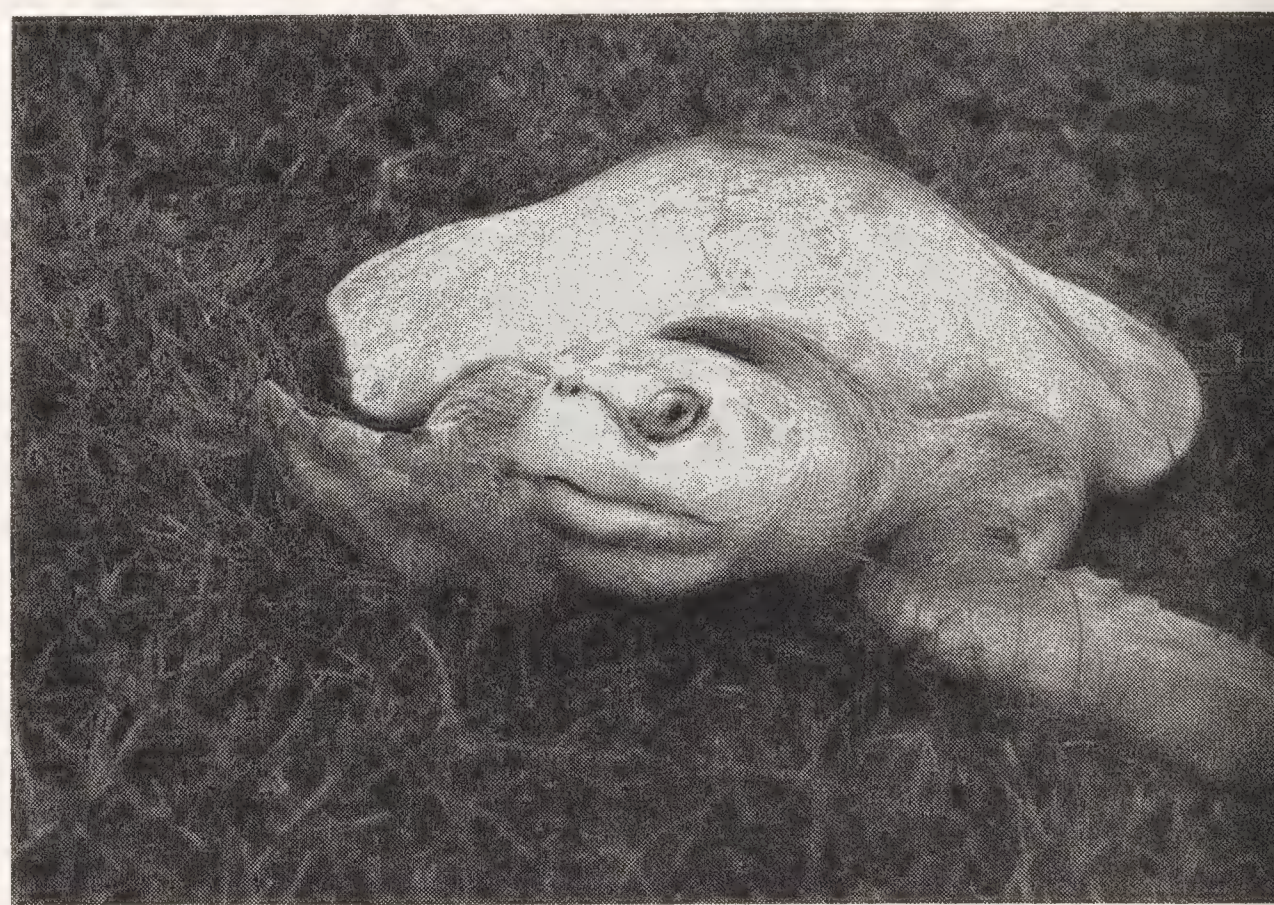
Left — Side view of a mature female Atlantic Ridley from St. Petersburg, Florida, largest Dr. Carr has seen. It weighed 93 lbs. Right — Mature male Pacific Ridley. Rough patches on the shell are red algae.

Photos by the author

people, but evidently only as stragglers. Nobody seemed to know the Loggerhead at all. The only breeding resident — more probably, a periodic migratory visitor — is the Ridley. Here and there I heard rumors of nesting by other sea turtles, but whenever these stories could be run down they proved to involve confused terminology or localities, or to be completely irresponsible. At Kino Bay, the Green Turtle was abundant, but the fine ocean beach that runs for miles from Puerto Kino to the craggy promontory at Kino Nuevo was strangely unmarked by trails, and nobody there knew anything at all of sea turtle nesting.

Our northernmost nesting observations were made in the Mazatlan area. From there southward all sections of the shore are evidently visited by nesting Ridleys each year. Their coming out is oddly thinspread, though. Nowhere is there traffic to compare with that at rookeries of the Loggerhead and Green Turtle. At Los Serritos, a few miles north of Mazatlan, at the peak of the season and with moon and tide just as the egg hunters said they ought to be to fill ovigerous turtles with hankerings for land, only four turtles nested in three nights on $2\frac{1}{2}$ miles of beach. At Sabalo, between Los Serritos and town, none nested on a mile of shore during the same time. On a mile and a half of beach near San Blas, three turtles nested in three nights; and at Matanchen near the same city, one mile yielded one nest on one night. At a place called Tamborito, just north of Teacapan, a careful search over a mile of high ocean beach that the people told me was a good place for turtles showed no trace of turtles at all. At the one house nearby the farmer told me the only tracks he had seen recently were

tracks may disappear completely during the day following the emergence of the turtle. A track count made from the air, or even afoot, will usually log only trails from the night before; while at rookeries of the other sea turtles an accumulation of all tracks made since the last heavy rain may be seen. Even taking this into consideration,



however, what I saw in Sinaloa and Nayarit seemed to indicate that nesting activity there is very thinly spread.

A tendency to solitary nesting may be the rule for the Ridley throughout its vast geographic range. During the height of the breeding season in Costa Rica, for instance, a female that my wife and I found on August 10, 1957 (11 P.M.), was the only sign of nesting on two miles of beach between San Isidro and Carizal (near Punta Arenas). In Guatemala, although Ridley eggs were common in the markets during early September, 1959, and although people at the port



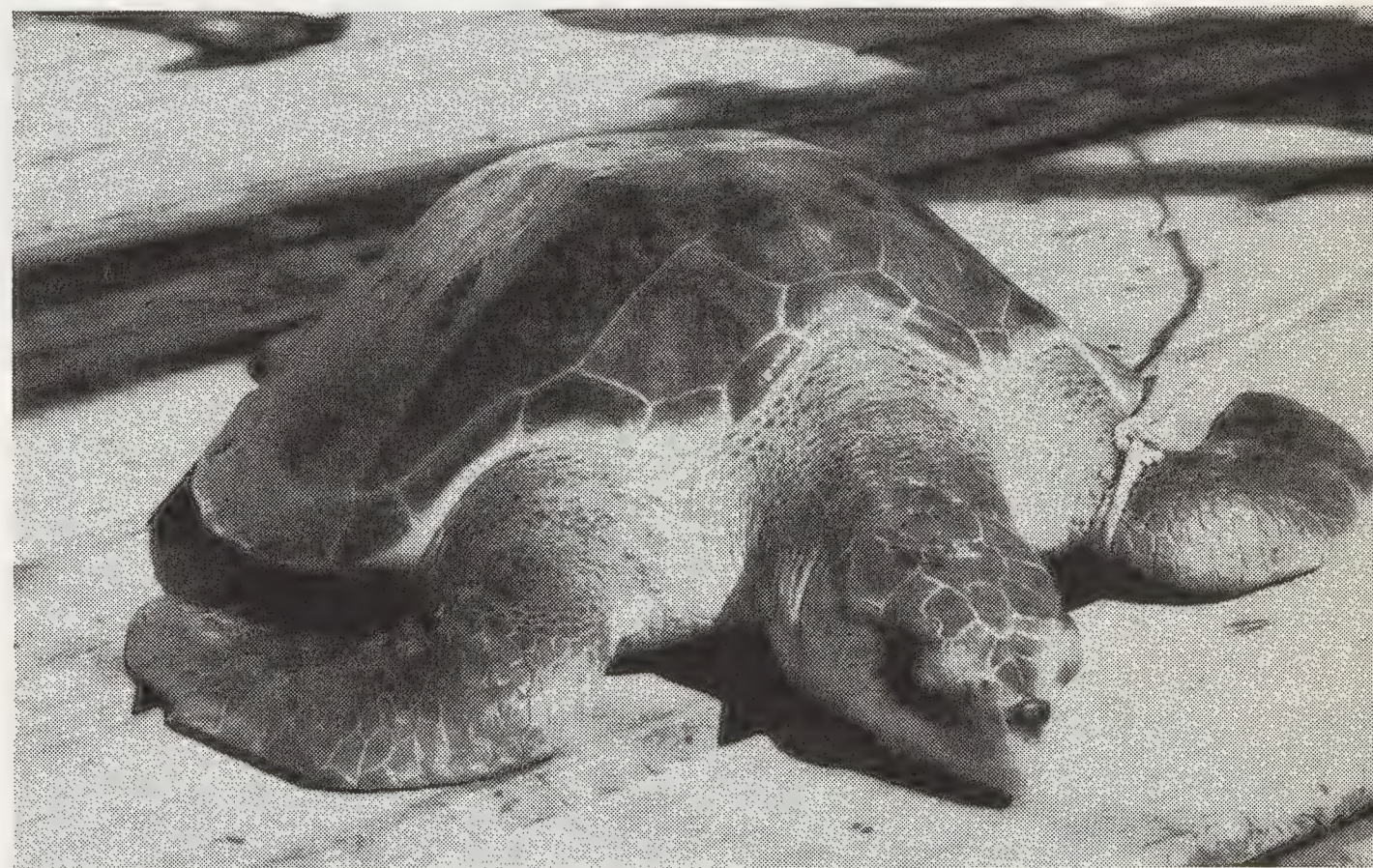
of San José told me the turtles often nested on beaches by the town, I saw no tracks in a mile and a half there on September 9. When Charles Bogert and I visited the Guerrero coast in 1952, Ridleys were nesting both at Playa Encantada south of Acapulco and at Pie de la Cuesta north of it. There were eggs in the *cantinas*, and since the people were killing all turtles that emerged, the discarded shells gave a rough idea of the amount of nesting going on. Such evidence as this, and the local consensus seem to show that nesting is everywhere scant and scattered.

During early August, 1960, I heard that large numbers of mated pairs of sea turtles were being seen by commercial and sports fishermen off Guaymas and Mazatlan. Hoping to observe

reconcile this concentration of sexually mature Ridleys offshore with the feeble show of nesting activity on the beaches.

Most of these turtles were easily approached and hauled aboard with a long-handled gaff hook. The back half of the shell of several of them was dull red, as if bloody from an injury. I have often seen female Green Turtles at mating time bleeding from wounds made by the long grappling nails of the male and thought the red Ridleys might have been injured this way. We caught one of them and found the color to be caused by encrusting red algae.

Stomach contents of the Atlantic Ridley are usually found to consist of crabs. Two Mazatlan turtles taken respectively 10 and 14 miles offshore had eaten nothing but tiny shrimp which packed the gut to distension. The average body length of the shrimp was only about an inch, and when I expressed surprise that a big-jawed Ridley should be able to feed itself on such tiny,



Left — The Atlantic Ridley shown above, for comparison of its silhouette with that of the Pacific Ridley on the right. The latter shows a characteristic flattening of the high, middle part of the shell.

Photos by the author

courtship and mating, I made two cruises — some 200 miles in all — off Mazatlan. On the first trip (August 22) three pairs of Ridleys were seen copulating, and single turtles were abundant between 8 and 15 miles out — not massed in schools, but for miles at a time more numerous than sea turtles I have seen anywhere else offshore. On the second cruise (August 26) turtles were even more abundant. In one section about 60 different individuals were sighted between 12 and 20 miles offshore in two hours' cruising. All these turtles were alone, however, evidently having risen to breathe while feeding. It is hard to

agile prey the fishermen told me that the turtles eat, not shrimp, but *lama* (moss — filamentous algae?) in which the shrimp are thickly entangled. I doubt that. Except for a few brown filaments that seemed to me only broken-off shrimp antennae, there was nothing plant-like in the stomachs at all — only hundreds of the little shrimp, all of which had been swallowed whole.

Part of the mystery that has surrounded the breeding habits of the Atlantic Ridley may merely be a result of its disinclination to congregate in big gatherings at nesting time. I formerly dis-



carded this idea because it seemed to imply that Ridleys were simply being overlooked in the rookeries of the other species. With all the attention these nesting grounds were getting this seemed unlikely. Now, however, an accumulation of stray facts shows that Ridleys nest regularly if scatteringly, along a section of the coast of the Gulf of Mexico hardly used at all by other species, from Montepio, abreast of the Tuxtlas in Veracruz to Padre Island, Texas.

When a recent summary of information on the Ridley question was published, evidence of nesting in three localities in Veracruz (Anton Lizardo, Nautla and the Alvarado area) was available. Widespread verbal reports of nesting by the *lora* or *cotorra* (as the Ridley is called along the Gulf in Mexico) at Montepio were mentioned. Later, during May, 1958, my friend Leonard Giovannoli visited Montepio at what, according to local word, should have been the height of the nesting season. He found there almost precisely

what I had found the year before at Anton Lizardo, 100 miles to the northward: the remains of two females freshly killed while nesting, few other tracks on the beach, and the local people so scared by recent threats of turtle-law enforcement that little could be learned from them.

When these nesting records began to turn up in Veracruz my attention was turned to Padre Island — the long narrow sliver of an offshore bar that runs from Corpus Christi to Brownsville, Texas — as a place that ought to be explored for Ridley nesting. Preliminary inquiry among local fishermen there was discouraging. People who appeared to know the coast well were sure that no turtles nested on the island. But in 1959 Mr. Kay Eoff of Brownsville, a graduate student at the University of Florida, found a man who travelled the coast extensively in a beach buggy, and who said that once in a while he saw turtle tracks there. In September, 1960, after fruitlessly canvassing people along the Padre Island

beach, I came upon the shells of five mature female Ridleys displayed for sale in a gift shop in Port Isabel at the southern end of the island. These represented more mature Atlantic Ridleys than I had seen in all my years of searching. Learning that they had been caught by Mexican

Laurence found not one nesting Ridley, but two, on trips two years apart, as detailed below.

(1) June 3, 1948, Padre Island, Big Shell Banks, 6/10 mile south of Old Yarborough Pass, which is 25 miles southwest (along Padre Island Beach) of Gulf Beach Park. The latter is 23



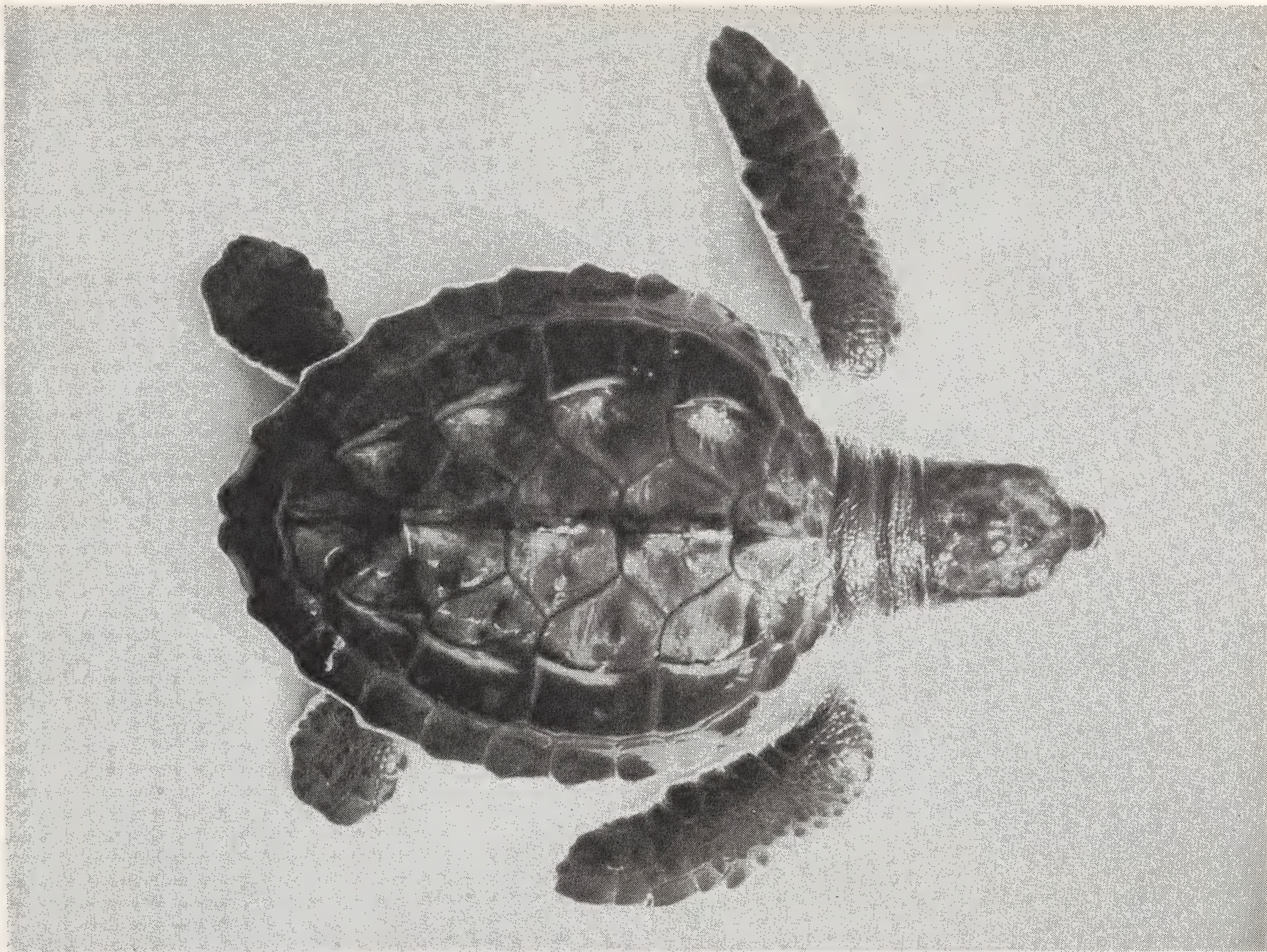
shrimp boats, I went down to the shrimp docks and showed the shells to the crews. They seemed quite familiar with the kind of turtle represented, called it *lora* or *cotorra*, as they do in Veracruz, and said it was the only common species thereabout and that they usually caught it when trawling close inshore in spring and early summer. They said that when butchered the turtles often were found to have shelled eggs in them.

On my return to Florida Mr. Larry Ogren knocked my feet out from under me by calling my attention to one of the New York Zoological Society's papers (Werler, John E., 1951, *Zoologica*, vol. 36, n. 3, pp. 37-48), completely overlooked by me, telling of the observing by Mr. Jesse R. Laurence of Corpus Christi, Texas, of a Ridley nesting on Padre Island. I at once telephoned Mr. Laurence, who is County Engineer. He kindly looked up the pertinent data, together with photographs substantiating the identification, and sent them to me. It turns out that Mr.

These photographs of a Ridley nesting on Padre Island, Texas, were made by Jesse R. Laurence of Corpus Christi and are the first ever made of the Atlantic Ridley's egg-laying.

Photos from Jesse R. Laurence





Eggs from the nest of the Atlantic Ridley discovered on Padre Island were dug up and incubated on two occasions, and a total of seven hatched after 58-62 days. This is one of them.

Photo from Jesse R. Laurence

miles southeast (down Mustang Island Beach) of Port Aransas Pass. A turtle weighing about 80 pounds laid about 100 eggs in a hole some 6 to 8 inches in diameter, 15 inches deep, and "belled out" at bottom, located 50 yards above high tide. Eighteen eggs, dug up and incubated in a bucket of sand, after 58 days produced two little turtles. A photograph of one of these, clearly a Ridley, was reproduced in a newspaper account, a clipping of which Mr. Laurence sent me. This is the first published record of nesting by the Atlantic Ridley.

(2) May 23, 1950. Padre Island, 22 miles south of Gulf Beach Park (see above), "about a mile inside Little Shell Banks." A turtle weighing about 100 pounds laid about 100 eggs, of which 27 were taken to Corpus Christi and put in a basket of sand. Five of those hatched, begin-

ning July 25 (after 62 days). Mr. Laurence's excellent pictures of the nesting turtle are the first ever made.

The trips on which the above observations were recorded were made by jeep, from Corpus Christi, for the purpose of gathering data for a proposed road from Port Aransas to Port Isabel. No other turtles or tracks were seen. The most surprising feature of Mr. Laurence's observations was that both turtles were found nesting in the daytime, an occurrence extremely infrequent among other species. Of hundreds of nesting turtles I have seen, none has been on the beach earlier than twilight or later than gray dawn.

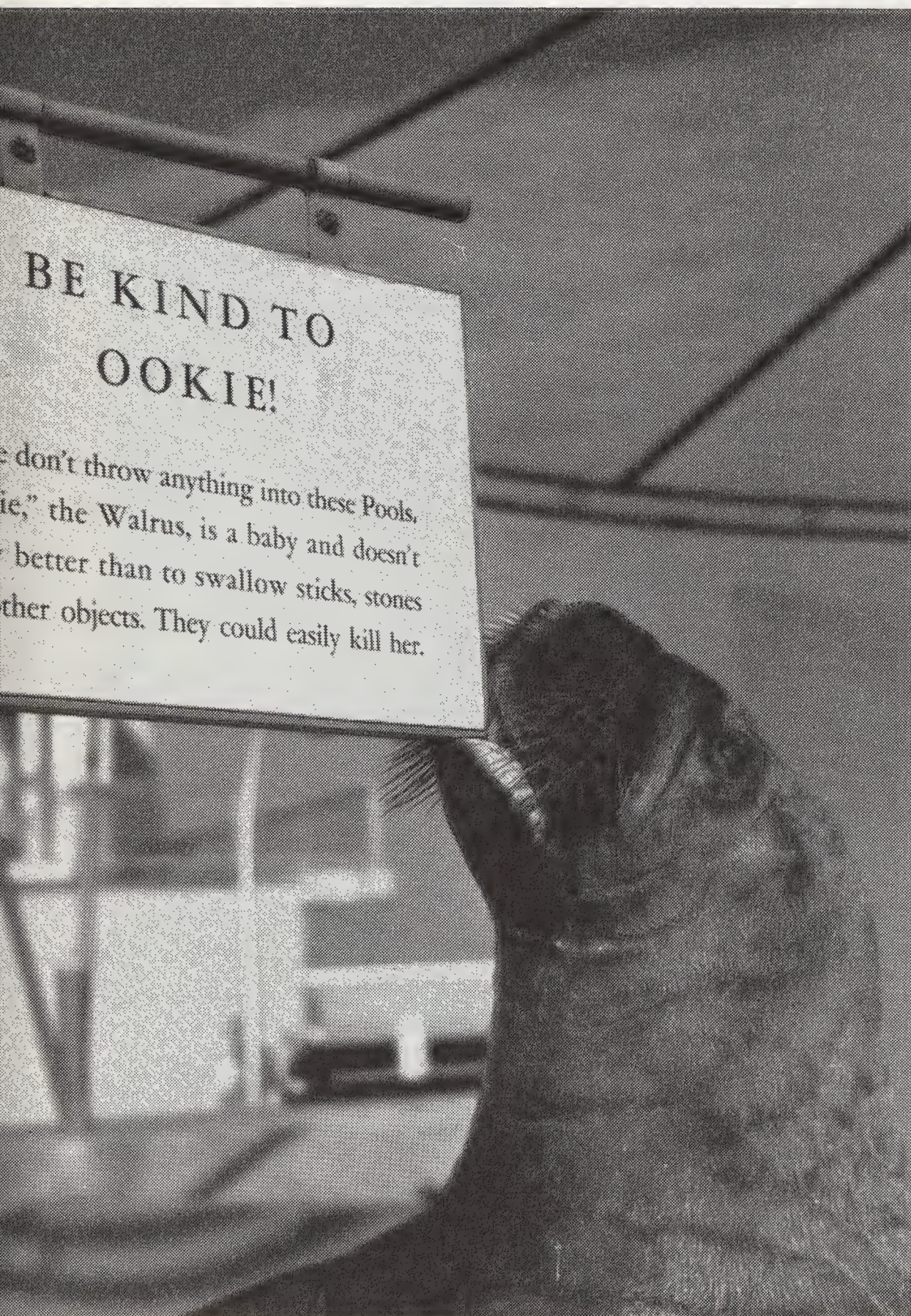
It now seems reasonable to offer as partial explanation of the durability of the "Ridley mystery" these factors: (1) scattered nesting emergences, with no rookeries formed; (2) lightly cut emergence trails, easily obliterated by natural causes; (3) a nesting range comprising little-visited, and in some cases, almost inaccessible, shores, such as Padre Island and parts of the Gulf Coast of Mexico; (4) nesting by daylight.

RAISING OOKIE

By JAMES W. ATZ

*Associate Curator,
New York Aquarium*

Photograph by Emmy Haas



NOT ALL WILD ANIMALS are wild. Some have personalities as gentle and friendly as those of the most amiable dogs. If anyone doubts this, I challenge him to spend just ten minutes watching the Aquarium's young female Pacific Walrus, Ookie.

As a matter of fact, any healthy young walrus would do, because there never has been an unfriendly captive walrus or one that did not give every evidence of enjoying its unnatural surroundings. Just why this shellfish-eating monster from the wilds of the Arctic, whose only relationship to man for centuries has been as a target for hungry hunters, should so enthusiastically adapt to life in captivity is a fascinating problem in animal behavior. To me it is the most remarkable aspect of this truly remarkable animal.

Although it is true that most walruses kept in zoos and aquariums have been captured when just a few days or weeks old, most animal babies born in the wild never lose a certain skittishness and reserve where people are concerned — a condition that becomes more pronounced as they grow up. This is certainly characteristic of the larger flesh-eaters, including the seals and sealions. Baby walruses, however, immediately take to people with all the abandon of a puppy, and they maintain this affectionate attitude at least through adolescence. Gine and Thora, the only female walruses ever to grow to adulthood in captivity, were friendly throughout the seven and twelve years they spent, respectively, at the Copenhagen zoo. Even Rowdy, the 12-year-old male on exhibition at the Carl Hagenbeck Tierpark in Hamburg, who was not captured until he was about one year old, has a friendly disposition.

Baby walruses may become particularly attached to the person who cares for them or regularly plays with them, but they never give *anybody* the cold shoulder; captive walruses simply like people! Whenever we want to give a visiting dignitary a special treat, we "introduce" him to Ookie. No matter who it is or what the time of day, Ookie quickly comes to be greeted and petted, eager to make any acquaintance, however brief. It never fails: man meets animal with ob-

vious mutual delight. We daresay that Ookie's whiskers are the best-known and most felt in all walrusdom!

From all this it might be concluded that walruses are the aquatic mammal *par excellence* for zoos and aquariums, and that only their inaccessible habitat in the fastness of the north keeps more of them from being put on exhibition. The truth of the matter is that despite the remarkable way they "take" to captivity, walruses have proved to be one of the most difficult of all large mammals to rear. The problem is to provide the unweaned babies with an adequate diet. In a recent article in *Animal Kingdom*, Dr. Carleton Ray described some of the trials and tribulations he experienced in developing a satisfactory diet for Ookie. But baby foods and formulae are a thing of the past for Ookie now. Since October 27 she has been eating whole shucked clams and raw fish, just like an adult.

The first step toward Ookie's weaning was taken last May when she was broken from the calf-bucket, from which she had been taking her formula of blender-mixed raw clams, whipping cream and vitamins, and was taught to eat from a pan. Like any baby, she resisted this change in eating habits. When the story of our first futile attempts to get her to abandon the calf-bucket nipple was printed in newspapers as far away as Anchorage, we received many letters and even one telegram telling us how to do it. Many of our advisers were country folk who had had experience with livestock, principally calves. But Ookie was a walrus, with a mind of her own, and we lacked experience as to just how far a young walrus should be pushed. For some time Ookie ate from the pan only if a tankman held the nipple submerged in the formula for her to suck on. Finally, however, on July 19, we hardened our hearts; Ookie must eat by herself. Sure enough, she did not starve herself for long. In nature, some young walruses stop nursing at the age of 18 months. We therefore began to reduce the amount of cream in her formula late in July, when she was about 15 months old. On October 21, all cream was eliminated from her diet without the slightest protest on her part, and one week later whole clams were substituted for chopped ones. Ookie now consumes 40 pounds of clams a day, as well as nearly ten pounds of fish which

she has been receiving in gradually increased amounts for the past eight months.

The proof of the eating is in the weighing, and the scales attest to the adequacy of this regimen. At the end of October, Ookie weighed 490 pounds, an average gain of slightly more than 20 pounds each month during the 15 months she had been at the Aquarium. Female Pacific Walruses attain a weight of about 2,000 pounds, however, so Ookie still has a lot of growing to do. Incidentally, the weighing procedure was a nice demonstration of how completely Ookie trusts the men who take care of her. Most sizeable mammals react strongly against anything that feels unsteady under them. Ookie, however, three times climbed upon a makeshift wooden platform that added its rocking motion to the inherent horizontal movement of a weighing machine's platform. Nothing mattered as long as she could nuzzle Head Tankman John Blair's cheek.

Another aspect of the feeding habits of walruses that has caused serious trouble is their proclivity for picking up foreign objects in the mouth, playing with them and then accidentally or intentionally swallowing them. This unfortunate behavior caused the death of Herbert, the popular Atlantic Walrus at the Zoological Park, nearly eight years ago, and more recently killed another young male in the Munich Zoo. Both died as a result of swallowing a small rubber ball thrown into their enclosure by some thoughtless visitor. Like other walruses we have known, Ookie spends a significant amount of time going over the bottom of her pool with her sensitive mouth and whiskers. Practically nothing escapes her; she often picks up objects as small as a BB shot. Such "vacuum cleaner" actions may be associated with normal feeding behavior during which walruses grub on the bottom for the bivalves that comprise the bulk of their natural food. That other factors may enter into the picture is evident, however, from the regular occurrence of stones in the stomachs of wild seals and sealions and the not infrequent death of captive ones as a result of eating everything from bottle-caps to coal. Why this should be, we do not know, for some seals and sealions feed on fish and squid and do not have to grub food among foreign objects on

(Text continued on page 21.)



Ookie has a broad streak of gregariousness in her nature and if she can't be with her keepers or visitors, she seems to get great satisfaction from looking at them and "talking" to them.

A white rubber ball has been Ookie's favorite plaything ever since it was given to her last summer. If it pops out of the water and goes over the wall of her pool, her outcries bring a keeper to retrieve it, and if it pops onto her haulout platform, invariably she rolls it back into the water, for she wants it near at hand, whether she is playing with it or not. She can manipulate the ball with either her front or hind flippers, and often pushes it around the pool with her nose. Sometimes she spits a jet of water 3 feet in the air (below). This seems to be a walrus habit.

Photographs by Emmy Haas







The wall in the two pictures at the left is 57 inches high — but Ookie could climb it. All she needed was a chance to get her flippers over the top. Eventually the Aquarium had to put still another board atop this gateway, for there was danger of her falling and hurting herself. In the two photographs at the right, the wall is 38 inches high. It presents no problem at all. She curls her hind flippers under her body and simply “walks” up the wall. When the bulk of her 500 pounds projects far enough, gravity does the rest. She doesn’t mind the bump when she falls.





A 7-foot wall finally foiled the climbing walrus. It is high enough to discourage her from even trying to climb it but it does disrupt the open appearance of the walrus-and-seal Tripool.

the bottom. So far, Ookie does not seem to have swallowed many of the sharp, toxic or otherwise noxious objects put into her pool by foolish visitors — those who escape our patrolling tankmen or who fail to heed the special labels that warn of the danger to Ookie from such impulsive acts as tossing her a “plaything.” Whenever any of us pass Ookie’s pool, we always look to see whether some object is there that doesn’t belong, or whether Ookie appears to be mouthing something. Ookie, trusting soul that she is, never fails to come when called, so that we can take the offending object away from her. Of course, we then always play with her for a while — in order to compensate for the loss of her dangerous plaything.

Our young walrus enjoys people in the mass as well as individually. The larger and noisier the crowd around her pool, the better she seems to like it. She swims back and forth, belly-up in one direction and belly-down the other. She bobs out of the water as far as she can and slaps the surface with her flippers, splashing her admirers — not, I am sure, with the intention of getting people wet, but because of the flurry of excitement that her unexpected maneuver evokes. School children seem to be her especial favorites, probably because of the noise and commotion they make. She has become a proficient “spitter” and can send a graceful jet of water several feet into the air while swimming at the surface on her back. Ookie’s latest toy is a nine-inch white rubber ball. At first she handled this quite awkwardly, but now she expertly manipulates it with snout or flippers, on land and in the water. On occasion, when the spirit moves her, she will retrieve her ball like a dog and push it up the side of her pool so that a favored visitor can toss it across the water again.

Ookie has also become expert at the scaling of walls. For some time she had been getting up on her hind flippers and hanging over the 37-inch walls that separate her haul-out from those of the seals in the other two units of the Tripool. She would often tip precariously on top, her hind flippers completely off the ground, but eventually she always backed down, apparently deterred by her inability to touch solid ground on the far side. We realized that sooner or later she was going to get over, but we knew that no immediate harm

could come either to her or the seals, so we waited, hoping for the inevitable to be put off as long as possible. Saturday, August 27, was the day. I happened to be the staff officer on duty and was in the middle of my dinner when a combined roar and laugh from the crowd told me that something out of the ordinary had happened. Ookie was in the seal pool and lazily chasing the inhabitants, who were streaking around in a panic. The only danger was that she might accidentally corner a seal and that it would turn and bite her. Tankman Pedro Ponciano opened the gate between the two haul-outs, coaxed Ookie back to her own quarters and shut her in. Then Ookie really surprised us. Tankman Ponciano had been gone only two or three minutes when she was over the wall again and after the seals. This time mere coaxing didn’t work, and it was not until Ookie had chased two of the seals into her own unit that we got her back home. But the minute our backs were turned, she was in with the seals once more. Again and again and again. After an hour of this I remarked, half in fun, half in exasperation, that it was pretty sad when the animals were smarter than their keepers — at which the crowd laughed just a little *too* heartily. Finally, with the aide of Maintainer Al Barone, several planks, a large piece of plywood, a heavy shipping box and some rope, Tankman Ponciano and I rigged up a temporary barrier and demonstrated our superiority over young Ookie. I know she couldn’t have slept sounder that night than I did.

But I was not yet through with Ookie’s penchant for climbing. Eleven days later, just as I was about to leave for home in the evening, Ookie climbed over one of the Tripool walls which had been raised to an unclimbable (we thought) 49 inches high by means of two six-inch planks lashed on top of it. This was serious, because now Ookie would be able to climb the outer walls of the Tripool and escape altogether. Still worse, she might hurt herself when she toppled down from a wall more than four feet high. This time Maintainer Joe Cadorette and I managed to confine our agile walrus by putting her into one of the pools and then letting almost all of the water out. Subsequently Ookie demonstrated that she could surmount walls that were 57 and even 66 inches high, although we did not

BIRD-BANDING IN THE ARIMA VALLEY



By DAVID SNOW

*Resident Naturalist,
Department of Tropical Research*

IN JUNE OF 1958 my wife and I began trapping and banding birds at the Zoological Society's Field Station in the Arima Valley of Trinidad. The primary aim was to color-band our local population of manakins, small forest-dwelling birds whose communal displays I was studying, but we found that we caught so many

Dr. Snow sets his mist-nets in the forest outside of Simla. The sunlight is making them rather conspicuous in this glade; best results are obtained when the nets are set in shadows.

Photo by Russ Kinne

other species as well that we soon extended our program to cover as far as possible all the local birds. We have now been trapping regularly for nearly 2½ years. Such a program produces more and more interesting results the longer it is continued.

Like so many other bird-banders, we use Japa-

nese "mist-nets." Mist-nets are made of black nylon thread so fine that the birds usually do not see them and fly straight in. Threaded through the nets, which are about 9 feet high and up to 40 feet long, are a number of thicker and tighter horizontal strands. When a bird hits the net the fine and very light mesh gives under the impact; the bird falls, and is held in a pocket against one of the tighter horizontal strands. There it hangs helplessly until removed. Mist-nets are almost completely harmless to small birds; in fact we have not had a definite case of a bird being injured by flying into a mist-net, though some, such as swifts, fly in at a considerable speed.

Catching a bird in a mist-net is easy; extracting it is sometimes a different matter. Birds with short or weak legs such as swallows, flycatchers and warblers are usually easy; they hang passively and do not get their legs badly tangled. Others, such as the Black and White Manakin (*Manacus manacus*) and the Bananaquit (*Coeleba flaveola*), sometimes struggle and claw up masses of net, perhaps twisting themselves round a few times in the process, and occasionally even managing to pass, with all their coils round them, bodily back through a single mesh of another part of the net. These birds demand much patience, often at times when heat, rain and mosquitoes are combining to exhaust what little patience one has left. In extreme cases we have to resort to scissors and snip a strand or two of the net; then the bird will usually come free quite quickly, dishevelled but none the worse for the experience.

We began by setting our nets along a path just behind our house, between two pieces of bushy cover at the edge of the secondary forest which abuts on the garden. Our catches here are often good and this has remained one of our main trapping stations. In the afternoons we often move the nets a little way up the stream which flows down past the house, and set them across the stream at places where the water is shallow and birds come to bathe. Especially on hot dry afternoons these bathing places are among the best places for catching good numbers of birds in a short time. But not all the species bathe in streams; some, for instance, bathe up in trees in water collected on leaves or in bromeliads. Thus one must study a bird's ecology and be-

havior and place the nets where the bird will come down low enough to go into them. Or if one is after a special bird which keeps high in the trees, one can hoist the nets up into the trees, as Bill Conway did to catch the Mossy-throated Bellbird (*Procnias averano*) in Trinidad last year (see *Animal Kingdom*, May-June, 1959), but this is a slow and skillful operation and for our general trapping program we have set our nets at ground level.

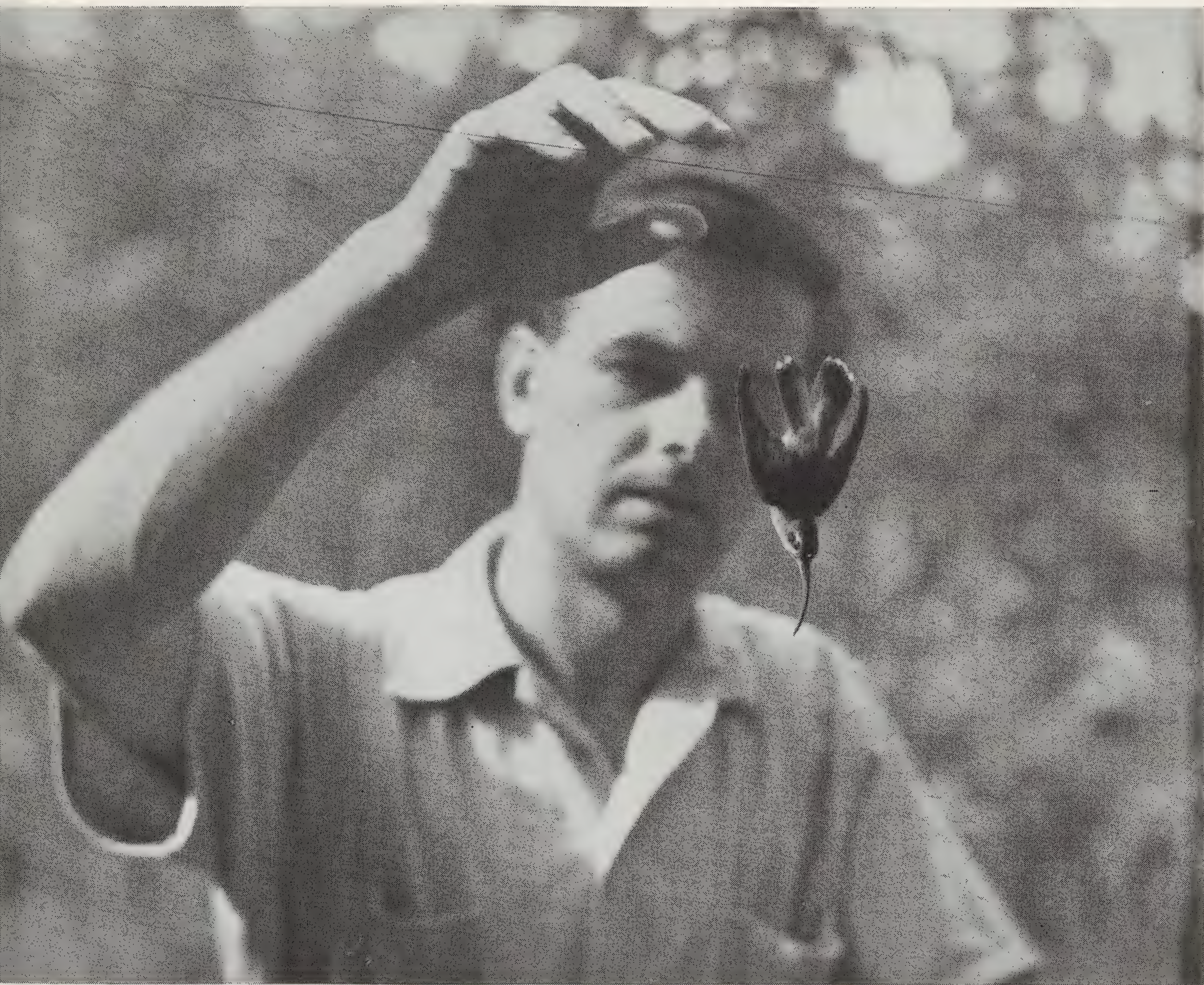
Each bird we catch receives a good deal of attention in addition to its band or bands. First, having noted as a matter of course the date, time of day and locality, we put the bird in a cloth bag of known weight and weigh it with a fine spring balance. By accumulating large numbers of weights we hope to find out whether tropical birds, like northern birds, show regular seasonal changes of weight due to deposition and loss of fat, or whether, as is perhaps more likely, they remain at a constant weight throughout the year. We shall also be able to test for diurnal changes in weight, for differences according to age and sex, and perhaps for other points that we have not yet thought of.

A Rufous-breasted Hermit hangs in the mist-net. It is sometimes difficult to disentangle a small bird but the capture does not harm them; of the hundreds Dr. Snow has caught in nets, none has been injured.

Photo by Russ Kinne

We then examine the bird's plumage, noting whether it is adult or juvenile, male or female, and seeing whether or not the bird is moulting, and if so, what parts of the plumage are being replaced. We measure the wing, which is the best standard measurement of a bird and one that often indicates the sex in species in which the sexes do not differ in color. In some species that show individual variation we note the color of the eye or beak.

Then we band the bird. What bands we use depends on the species. If it is one which we are studying in detail, we give it a combination of colored bands which enables it to be distinguished as an individual when it is seen in the field. If it is a local breeding bird of some other species, we give it a numbered band so that we shall know it again when we retrap it. Finally, if it is a migrant, we give it a U. S. Fish and Wildlife



Service band, so that its recovery can be reported if it is recaptured or found dead in any part of the world. Having done everything, we release the bird at or very close to the spot where we caught it.

After its release, the newly banded bird usually flies to a perch near by, preens vigorously and pecks a little at the strange band on its leg. But it soon accepts the minor encumbrance, and in fact seems not to be handicapped by it at all. There is no evidence that well-fitted bands jeopardize a bird's further expectation of life.

One of the most striking things we have found is the great abundance of individuals living in a small area of forest. So far, trapping just behind our house and a little way up the stream in the forest beyond, we have trapped 469 different Golden-headed Manakins (*Pipra erythrocephala*) and 229 different Black and White Manakins

(*Manacus manacus*). We still have not come near the end of the Golden-headed Manakin population as we still trap far more new birds than "retraps." For instance, the last page of our trapping book records 27 new ones and only 5 retraps. For the Black and White Manakin the picture is rather different. For some time now most of the birds we have trapped have been retraps. We do not yet know whether this difference is due to the Golden-headed Manakins simply being more abundant than the Black and Whites, or to their ranging more widely in the course of their daily activities.

Another species that turns out to be surprisingly abundant is a small and inconspicuous flycatcher, the Ochre-bellied Flycatcher (*Pipromorpha oleaginea*), of which we have caught 110 individuals. This may be contrasted with our catching one individual, on one occasion, of a

closely related species, the Olive-striped Flycatcher (*Mionectes olivaceus*). The ratio of 110:1 probably reflects fairly accurately the relative abundance of these two species. We often see the Ochre-bellied Flycatcher and find its nests, but we have never seen the Olive-striped Flycatcher, except for the one individual trapped.

Some of our local birds, though they probably never leave Trinidad, are seasonal in their occurrence in the Arima Valley. Thus the seed-eaters are not common with us in the dry season, but when the grasses begin to seed, shortly after the wet weather begins in May, they move up into the valley and start to nest. We have only trapped the Black and White Moustached Finch (*Sporophila bouvronides*) and the Gray Seed-finch (*S. intermedia*) in June, the Blue-Black Grassquit (*Volatinia jacarina*) in June and August, and the Lesser Thick-billed Seed-finch (*Oryzoborus angolensis*) from May to October. Other species we trap in all months but much more at certain seasons than others. Thus the ubiquitous Bananaquits, perhaps the most numerous birds in Trinidad, finish their moult in August and then become very active and sing a great deal. At the same time some of the forest trees,

on whose flowers they feed, begin to bloom. The Bananaquits move up the valley and enter our nets in greater numbers than at any other time. The Rufous-breasted Hermits (*Glaucis hirsuta*), common hummingbirds of the forest, take up their territories along the forest streams early in the year; in January and February many of them go into our nets as they move up the valley to their favored nesting habitats.

We do not catch many northern migrants. Trinidad is rather on the edge of the main South American wintering area for North American warblers and other migrants, and only a few species are at all common. But our few captures have produced a most interesting record. A Northern Waterthrush (*Seiurus noveboracensis*), caught and banded on December 10, 1958, flew into a net placed in the same position almost exactly a year later, on December 23, 1959. This appears to be the first time that a northern migrant wintering in the tropics has been proved by banding to return to the same winter quarters in successive winters. That the bird was not on passage is indicated by the fact that we recaptured it on April 3, 1960. We would give a lot to know by what feat of navigation it returned. Did





Left — A color band is fitted onto the leg of a female Black and White Manakin, after which it will be released. The color distinguishes this particular bird when it is seen again in the wild. Above — Another step in the study is to place the bird in a cloth bag of known weight and then weigh it with a sensitive spring balance. Right — The wing of Guaimard's *Elaenia* is measured. This is an uncommon flycatcher occasionally caught in the nets.

Photos by Russ Kinne

its long sea-crossing over the Caribbean bring it directly to the Arima Valley, or did it hit the coast many miles to the east or west, and home by stages to this forested valley which looks so like all the other forested valleys of the Northern Range of Trinidad?

Among the most interesting of the results of a long-continued trapping program is the knowledge that it gives of the lives of individual birds. Many individuals have been caught and recaptured

several times. Of the color-banded manakins, many have been seen at other times, displaying at their courts, nesting, feeding and bathing. We are beginning to learn, for instance, how long a bird takes to acquire its adult plumage, how much of the year is occupied with the moult, how the date at which its moult begins may vary in successive years, and many other things. For the Black and White Manakin we have the most complete data. For example we have been able to follow one individual male from the egg and through its nestling period (banding it when 9 days old), have recaptured it as an independent juvenile, have watched it in juvenile plumage hanging about round the edges of a display ground and making its first tentative jumps, and



have then seen it in full male plumage, some fifteen months after leaving the nest, trying to acquire a court among the other adult males at the same display ground.

We would not be without our mist-nets now. Though exasperating at times, they give us knowledge that could not be got in any other way. For many kinds of field study they rank with binoculars and bird-bands as the ornithologist's most valuable tools.

News from the Conservation Foundation

Arctic Wildlife Range

In 1952 the Conservation Foundation and the New York Zoological Society jointly sponsored an ecological reconnaissance of wildlife habitat in Alaska. The study was undertaken by Dr. A. Starker Leopold and Dr. F. Fraser Darling and resulted in publication of the book *Wildlife in Alaska*. That book contained the following recommendation: "The Eastern Brooks Range sloping down to the Arctic plain on the North and to the Yukon Valley on the South would be an ideal Arctic Wilderness area. Not only would such a reservation serve to maintain a sample of the primitive northland for posterity, but it would be a base for long-term ecological studies of the arctic flora and fauna."

In his foreword to the book, Fairfield Osborn stated: "An Arctic Wilderness area should be set aside in the Brooks Range of Northern Alaska to protect an adequate reserve in the wonderful primitive region for posterity."

In 1956 the two organizations jointly sponsored an exploration in the Brooks Range by Olaus and Mardie Murie, who were accompanied by H. Robert Krear as photographer. Their report again recommended establishment of an Arctic Wildlife Refuge in the Brooks Range and specified desirable boundaries therefor. The film taken on this expedition, showing the wildlife and wonders of the area, was assembled from the Murie-Krear footage and shown widely in Alaska and the United States as a plea for establishment of the Refuge. The film was entitled "A Letter from the Brooks Range." Another and expanded version of this film was subsequently issued by Thorne Films under the title "Arctic Wildlife Range." Olaus Murie, himself, appeared before many sportsman's groups and representatives of the Alaska legislature advocating establishment of the Refuge, and Dr. Osborn together with the representatives of a number of other conservation organizations urged the Secretary of the Interior to set aside the refuge by executive order.

A bill was introduced in the Congress in 1959 and 1960, and although it was favorably reported,

it failed in passage in the closing days of the Congress. With the continuing encouragement of conservationists throughout the country, Mr. Seaton, the Secretary of the Interior — who had himself always warmly believed in the value of this great reservation — took action. As one of his final acts before the change of administration he issued the desired executive order. The Arctic Wildlife Range is now a reality.

Ecological Film

Now completely underwritten by gifts totalling \$40,000, the ecological film, "The House of Man," is in active production under the supervision of George Brewer and John Gibbs.

The film will deal with the availability and use of the earth's natural resources and with the changed and changing environment caused by the world's rapidly expanding populations and man's growing mechanical and technological power.

The story will be told essentially in terms of the North American scene but will also make clear that today's vast environmental changes are occurring at a constantly accelerating pace in other countries and cultures.

Briefly Noted

Fairfield Osborn, with the topic of "Man, Nature and Faith," addressed some 400 members of the Church Club of New York at their annual meeting at the Plaza Hotel on January 23 . . . Frank Darling, at the invitation of the Sudanese government, will spend six weeks in February and March in making an ecological reconnaissance of the Republic of the Sudan and advising on the setting up of a national park and game reserve there. He will be accompanied by George Merck . . . A luncheon for Professor Jean Baer, President of the International Union for the Conservation of Nature, was given by the Foundation on January 12 at the University Club. Guests included Montgomery Bradley, Ernest Brooks,

William Vogt, Carl Gustavson and Richard Pough . . . "The Impact of Recreation on Land Resources" was the title of a talk by Samuel H. Ordway, Jr., before a meeting organized by the Conservation Committee of the Garden Club of America on January 10 . . . Wallace Bowman served as Chairman of a session on Rural Land Zoning at the annual meeting of the American Association for the Advancement of Science, held in New York December 27-30 . . . On December 29 a luncheon for some of the members of the Ad-

visory Council of the Conservation Foundation was held at the University Club. Advisors Firman E. Bear, Harold J. Coolidge, Edward H. Graham, Charles M. Haar and Paul B. Sears, Associate Richard L. Meier, and Raleigh Barlowe, were welcomed by Dr. Osborn for the Foundation . . . Belmont Pitkin represented the Foundation at the Fourth Annual Conference of the Organization of Cornell Planners, held in Ithaca November 18-19. The topic for the meeting was Open Space and the Metropolis.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Exuma Cays Land-and-Sea Park Nears Operating Basis

The first real land-and-sea park, at Exuma Cays in the Bahamas, will soon be on an operating basis. Dr. Carleton Ray of the Aquarium staff brought back word of its progress after attending the annual meeting of the Bahamas National Trust.

The Zoological Society sponsored a survey of Exuma Cays in January, 1958, and a year later the Bahamas Legislature created the National Trust, of which Dr. Ray is secretary.

Two other areas are now being considered: Inagua Island, the home of West Indian Flamingos, the Bahamian Parrot and various terrestrial and aquatic reptiles, and Athol Island, to be developed as a public camping ground.

Argentine Journey May Lead to Collecting Expedition

Certain parts of Argentina are extraordinarily rich in bird life, yet comparatively little collecting is done there for the benefit of zoological gardens. At the end of the year Associate Director William G. Conway made a 1,400-mile journey through Argentina which may result in a major collecting expedition at a later date.

He traveled south from Buenos Aires to the great pampas, to Bahia Blanca, and over the Patagonian plateau to the Andes at Zapala, at

that point turning south to the Argentine lakes region, particularly Lake Naue Huapi. He left New York on December 16 and returned on January 8.

The trip was made essentially for scouting and photographic purposes, and will be reported upon more fully in a later issue of *Animal Kingdom*.

Other members of the staff have also been traveling. On February 1 Staff Photographer Dunton gave a talk before the Canadian chapter of the Biological Photographic Association at the Montreal Neurological Institute, speaking on "Biological Photography in the Zoo and in the Field."

Dr. Charles R. Gandal attended the annual conference of the Veterinary College at Cornell University early in January, and showed a new motion picture we have made, "A Field Technique for Pinioning Birds."

Society Participates in AAAS Meetings

The American Association for the Advancement of Science held its annual meetings in New York during the week between Christmas and New Year's and several members of the Society's staff took part.

Dr. James W. Atz of the Aquarium was Local Chairman for the Ecological Society of America. Dr. Herndon G. Dowling participated in a sym-

posium on "Evolution and Dynamics of Vertebrate Feeding Mechanisms." William Bridges was a member of a panel which discussed "Writing, Illustrating and Publishing for the Nature Audience" before the American Nature Study Society.

Two papers from the Society's Genetics Laboratory were presented, on fish bred in the Laboratory.

Dr. John Tee-Van was a member of the Honorary Reception Committee for the meetings, and on several occasions groups of scientists and their families visited the Zoological Park and the Aquarium, where special tours were held for them.

Javan Rhinoceros Hornbill Record

A longevity record that apparently has not been exceeded anywhere was set by a Javan Rhinoceros Hornbill in the Zoological Park's collection. At the time of its death on January 5, it was within 6 days of being 24 years in the collection, having come to us on January 11, 1937. Our only previous Javan Rhinoceros Hornbill arrived in 1921 and died in 1926. It will not be easy to obtain a replacement from Java or Sumatra.

New Zealand's Rare Tuatara: Now Five Years on Exhibition



On January 21 we noted with satisfaction that our Tuatara had been on exhibition for five full years — the longest period that any Tuatara has survived in the United States. A few others have been seen in American zoos, but most of them died in about a year.

The Tuatara (*Sphenodon punctatus*) came as a gift from the Department of Internal Affairs of New Zealand, which watches over the animal. It

is strictly protected. Although it looks much like a lizard, the Tuatara is actually a rhynchocephalian, the only member of its Order.

Because of the reptile's rarity (it is found only on a few islets off the coast of New Zealand) the Department of Internal Affairs keeps in touch with the institutions that have been permitted to exhibit specimens. Dr. Dowling's latest report to the Department said:

"It has been kept in a small exhibition case about 2 feet by 2 feet, with a water dish, a rock and a small log to rest upon. The exhibit enclosure is within a refrigerated section of the Reptile House and the temperature has been maintained between 65 and 74 degrees Fahrenheit. Although the temperature in nature appears to be lower than this, we find that our specimen is more active, in better color, and feeds more regularly at these higher temperatures. Humidity is high in the enclosure.

"The water of the enclosure is changed each day and the Tuatara is offered a baby mouse each day. This food is ordinarily accepted. Our specimen is quite active, barks occasionally, and sometimes attempts to bite when handled.

"On five different occasions, however, it has gone into an apparent state of shock shortly after feeding. The floor of the mouth and tongue appeared to swell, mucous fills the oral cavity, and the animal experiences difficulty in breathing. Under these circumstances, we immediately place the Tuatara under oxygen treatment and maintain it on oxygen for two to six hours. It appears to recover fully under this treatment. We still do not know the cause of these attacks. We have suspected that it is an allergic reaction to some substance obtained along with the food, and have set up elaborate procedures of cleanliness in order to avoid this. Even with these precautions, however, the attacks occur on an average of about once a year."

Dingo Pups Were the First Babies of the New Year

Eight pups were born to our prolific pair of Dingos, or Australian Wild Dogs, on January 1, and while we are glad to have them, for we want a young pair for the future, the "left-overs" pose a bit of a problem, for the "Dingo market" among zoological parks seems to be pretty well saturated.

Members of the Zoological Society take a second look at the animals at the Waldorf during the Members' Meeting on the evening of January 9. Approximately 2,000 heard Dr. Osborn announce the Society's campaign to raise \$7,000,000.



Our pair is partly responsible, for it has produced a total of 50 pups between its arrival on September 29, 1954, and January 1 of this year. Heretofore the pups (one litter as large as 11 and one as small as 5) were always born during the last few days of December, but this time they missed it by one day.

The Dingos came to us from the Taronga Park Zoo in Sydney. For the most part the female has been an excellent mother and she is taking good care of the present litter.

IN BRIEF

Andy's Reducing Diet. It has been all too obvious for a long time that Andy, the Orangutan, is too fat, and when he reached 450 pounds at his routine weighing in October the Mammal Department began doing something about it. Andy is now on a diet of three-quarters of a bucket of fruit and vegetables a day, instead of a full bucket. Deprivation is having some effect, too, for the January weighing recorded him at 415 pounds — a nice drop, but still a long way

from the level of about 350 to 375 pounds we would like him to attain. Andy can only be forced to reduce by separating him at feeding time from his companion, Sandra. When the two of them are fed together, Andy invariably takes the most and the best of the food.

Vandalism Again. The two best-known Penguins in the collection — indeed, the only two that have been known by pet names — have both been killed by vandals. "Annie," the celebrated Black-foot Penguin from the old Aquarium (who turned out to be a male, incidentally), was killed in February of 1959, and in December of this past year his mate, "Andy," (a female) was stoned to death.

Quicker than the Eye. Attempting to photograph the "strike" of the deadly Stonefish at the Aquarium — for its bite, when it snaps up its food, resembles the strike of a rattlesnake — Staff Photographer Dunton set his camera to take pictures at the rate of 64 frames a second instead of the normal 24 frames. He got a picture of a bite, all right, but it appeared on only four of the 64

frames, from the first opening of the fish's mouth and its spring forward until the prey had been engulfed and the fish had returned to its resting position. This indicates a speed of $\frac{1}{16}$ th of a second for the whole operation.

Nyala Herd Is Growing. The last weeks of the year usually bring an increase in our herd of Nyalas and this past year-end was no exception; three of these lovely antelopes were born in December and more are expected. The present herd of 18 Nyalas gives promise of a spectacular show on the African Plains next spring. It is probable that this is the finest Nyala herd in any zoo.

PUBLICATIONS OF INTEREST

A FIELD GUIDE TO THE BIRDS OF TEXAS by Roger Tory Peterson, published by Houghton Mifflin Company for the Texas Game & Fish Commission. Obtainable only from the Commission—\$3.00.

Texas has by far the largest avifauna of any of the fifty states. In this guide, Mr. Peterson covers all 542

species. Sixty full-page plates, including 36 in color, are based on patternistic drawings that indicate key field marks with arrows. This addition to the familiar Peterson Field Guide Series is recommended to everyone with an interest in North American birds. — G. W. M.

THE MUSEUM AT GHOST RANCH. A Pioneer Outdoor Interpretive Project in New Mexico. Bulletin No. 1. By William H. Carr. 36 pp., many illus. Charles Lathrop Pack Forestry Foundation, Washington, D. C., 1960.

William H. Carr will be remembered by many persons in the New York area for the pioneering work he did with nature trails and trailside museums at Bear Mountain State Park. In recent years he has been developing his ideas even more ambitiously in the Southwest—first with the Arizona-Sonora Desert Museum in Tucson and now with the Museum at Ghost Ranch 65 miles northwest of Santa Fe on U. S. Highway 84.

The Charles Lathrop Pack Forestry Foundation of Washington built the Ghost Ranch Museum, and Carr expresses its purposes in his new descriptive booklet: "We built the Museum in this untenanted but well visited region to inform the people of their country, of its vanishing wildlife, grass, water and soil, its wonders of life, past and present, and rehabilitation possibilities for the land in the future."

The booklet is a typical "Bill Carr production"—easy and informal in style, informative and convincing—which reflects Carr's lifelong and effective efforts to make Americans love and understand the out-of-doors as much as he does. — W. B.

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The Once and Future Cheetah

NO ONE, not even Mr. T. H. White, actually saw Merlyn transform Wart into the gentle Cheetah that presided at the Annual Members' Meeting at the Waldorf, so we persuaded Curator Joe Davis to make the drawing above. Maybe it didn't happen just the way Davis pictures it, but magic was certainly there, as real and palpable as Merlyn himself.

It's probable that Merlyn would have wanted Wart to be the Cheetah at the Waldorf, if there had been a Waldorf or Cheetahs in the time of the great once and future king. For it would certainly add to Wart's education to learn how it feels to be the admired and honored guest of our distinguished group of lovers and protectors of animals.

Of course, all of us can't be Wart and find out at first hand how an animal feels. Obviously, then, the next best thing is to learn—even at second hand—all we can about them.

To do this, there is no better way than Membership in the New York Zoological Society—and we hope you'll tell all your friends about it and ask them to join us at the first possible moment.

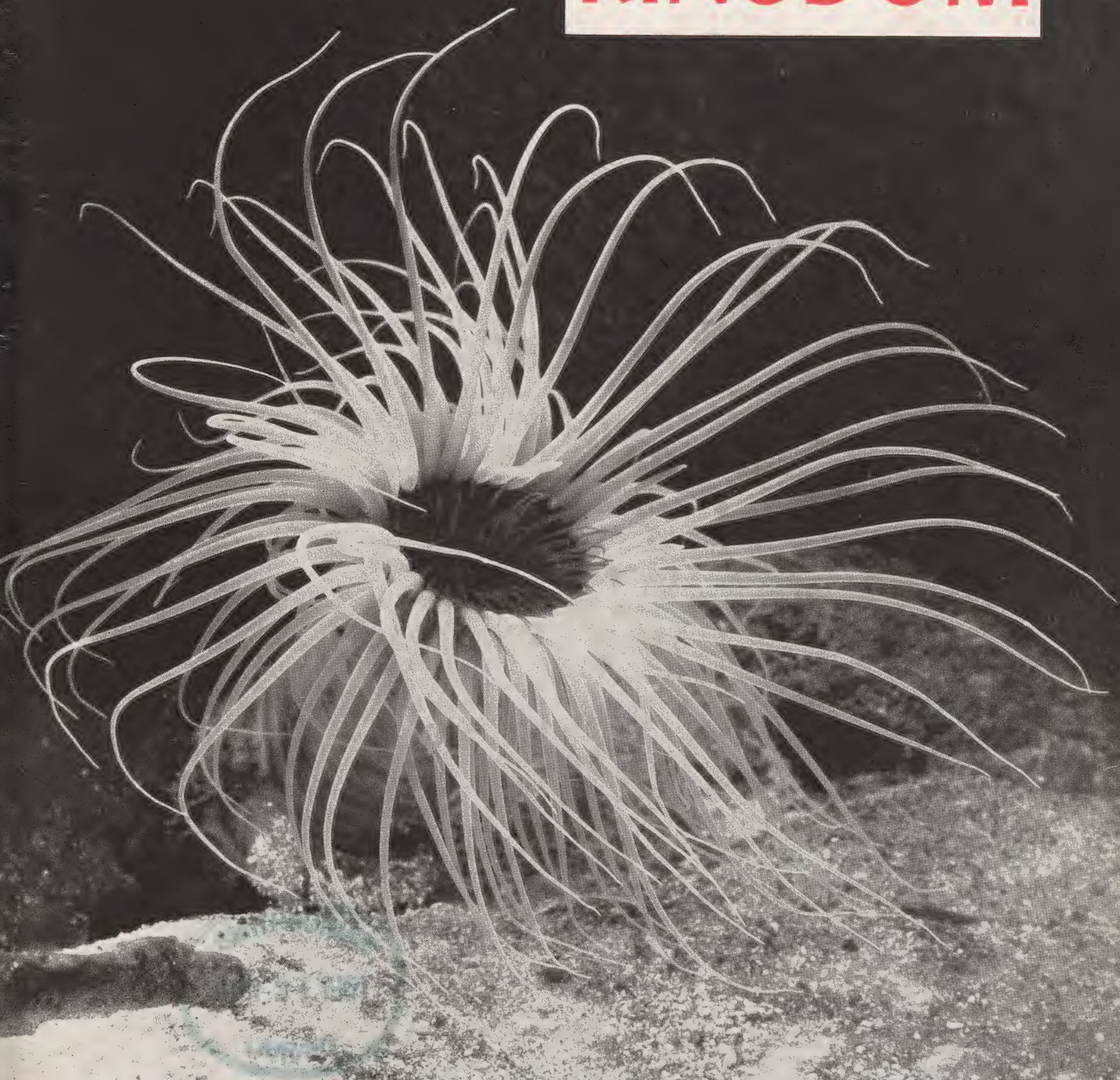
GORDON CUYLER
Membership Chairman



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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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THE CARE OF WILD ANIMALS

THE CARE of wild animals in modern zoos has come to be a highly complex art, involving many skills that were unknown even a few decades ago. An excellent development is today's recognition of the fact that to be healthy an animal must be content. Consequently, a great improvement has occurred in providing the animals with ample space as well as a pleasant environment and gentle handling. Much has been learned concerning proper diets and related health measures. So it is that extremely delicate species, such as hummingbirds, as well as numerous others, can now be maintained — a success that was unattainable even a few decades ago.

Today our Zoological Park has more than a thousand different kinds of animals within its collections. It is safe to say that in the early days of the century the attempt to keep many of these would only have met with failure.

Zoo management is a highly rewarding profession but as in any other, success is occasionally tempered with keen disappointments. For instance, it was a triumph when we were able to maintain two of the rarest, most temperamental animals on this earth — our Duck-billed Platypuses — for the long span of ten years, a feat never before accomplished and never likely to be duplicated. By contrast, sometimes there are sad happenings such as the death some years ago of young Herbert, the Zoo's endearing Walrus, who swallowed a tennis ball that some child unwittingly threw into his pool. Fortunately, triumphs far out-number such distressing accidents that can happen to all living things — people and animals alike.

As time runs on, new ideas will develop that will add to the welfare of our animals. For *only the best* is good enough for the wonderful creatures that are in our care.

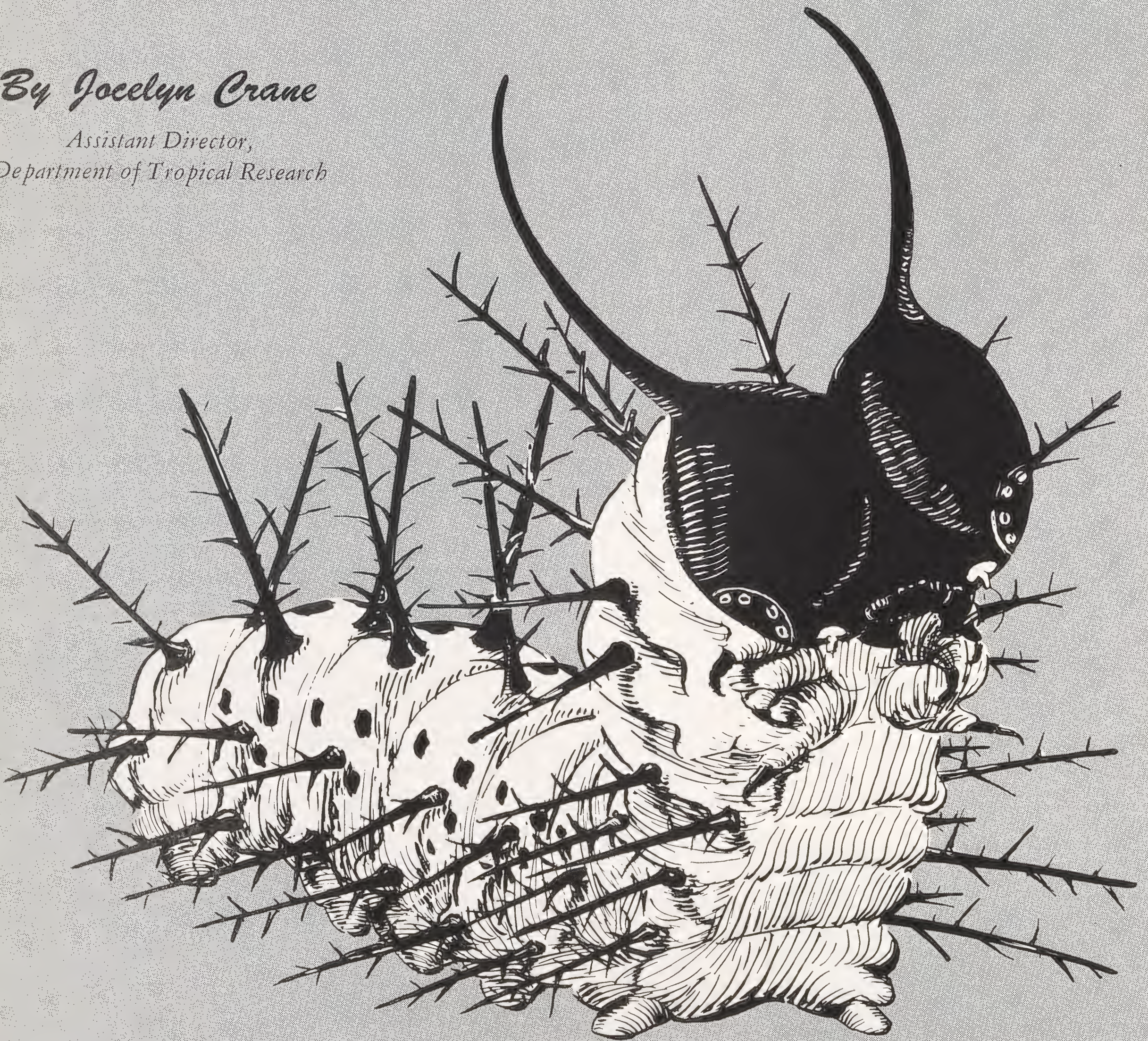
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Butterfly Discoveries and Surprises

By Jocelyn Crane

*Assistant Director,
Department of Tropical Research*



*Line drawings by
Frances Waite Gibson*

SOME SCIENTIFIC PROBLEMS give the lucky people who struggle with them a glow that lasts all through the work. The hows and whys of evolution in a group of brilliant butterflies give us that pleasure here at Simla, the Zoological Society's Department of Tropical Research station in Trinidad. And, while the largest mysteries remain, encouraging pieces of puzzle are frequently solved, like clues in a treasure hunt.

The butterflies all belong to a subfamily, the Heliconiinae, that is most abundant in the jungle glades of the American tropics. Here in Trinidad we have fourteen different species — an excellent number for the comparative work we need to do as a foundation for the research.¹

Fortunately for color-loving zoologists, most of the helicon butterflies flaunt bright patterns of scarlet, black, orange, blue and yellow in the best tropical tradition. All are more or less distasteful to their natural vertebrate enemies — such as birds, lizards and monkeys — and their “warning colors” are probably remembered by these animals after youthful gustatorial mishaps. Since the bright patterns protect the insects in this practical way, the color development has been encouraged by natural selection.

One of the first discoveries we made, some years ago, was the fact that the scarlet band on one of the species, *Heliconius erato*, is also of use in that butterfly's courtship. First of all we housed inexperienced young butterflies singly in roomy out-of-door cages,² and then watched their behavior when they were confronted with strangely painted members of their own species, and with odorless paper models. It was soon clear that a female painted black or blue was usually a wall-flower, while an all-red model was even more attractive than a normally banded one. Ultimately, when all proper experimental precautions had been taken, there was no question but that the bright red band characteristic of *erato* was an important asset in winning a mate.

Since then we have learned that various colors are also important in the courtship of several more of our fourteen helicons. On the other hand, we are now finding that in some of the species color plays no discernible part at all in their social lives;



This *Heliconius* butterfly is feeding from a *Lantana* in one of the butterfly houses at Simla. Two spots on its wing are dabs of yellow paint, put on to identify this specimen among its fellows.

Russ Kinne Photo

in these forms only special flight motions and the fragrant odors from scent glands are used in bringing the sexes together. Their yellow spots and tiger-like stripes seem to be wholly disregarded.

Surprisingly, one or two of these species are closely related to those that use color in their courtship. Butterflies as a whole have an excellent color sense, and it seems unlikely that their capacities differ within this single subfamily. How does it happen, then, that only some of the helicons use color in courtship? How did the attraction to a particular hue in a butterfly pattern first arise? Which came first, back in the early days of helicons in jungles of the past, species that used color in courtship, or those that did not? Such puzzles in basic science help our understanding of many

¹ The Department of Tropical Research wishes to express its appreciation for generous support of the study of helicon butterflies to the National Science Foundation (Grant G-6376), the National Geographic Society and the Alcoa Steamship Company.

² See *Animal Kingdom*, 1954, p. 138.



general problems in biology. Knowledge of animal vision, the development of social behavior, the relationships of behavior to physiology — all should benefit.

Another part of the helicon study has more nearly reached its end. Last season we finally reared enough material to disentangle the genetics of the variable, black-and-red helicons of Surinam. These striking polymorphic forms are characteristic of two species, *H. erato* and *H. melpomene*. Some individuals have much more than the usual amount of red. Instead of a single vivid band across the forewings, scarlet radiations make sunbursts at the wingbases, and there are often other additions to the gaudy pattern. It was already apparent to us, as mentioned above, that red has a double adaptive value, being useful both in courtship and in warning off enemies. Since, in Surinam and nearby countries, the red is capable of this extra development, we wondered why the forests were not full of solid red butterflies, all superbly protected and all outstanding social successes.

In 1954, Dr. Beebe, Henry Fleming and I made a field trip to Surinam investigating possibilities for studying these polymorphic species.

We managed to collect a tantalizing sample of eggs, and proved they could be transported to Trinidad, reared to adulthood and bred through our facilities at Simla.

We had no time to try again until late in 1958, when Mr. Fleming and Field Assistant Sonny Ramlal once more brought back a group of eggs. The following weeks were sad ones because, after a healthy beginning, the stock was struck by a whole series of mysterious diseases.

While we never quite reached the point of sitting up all night with a sick caterpillar, the broods caused us much anxiety with their numerous ailments. We did all we could, sterilizing dishes and instruments, maintaining an isolation ward and trying to interest our medical friends in possible new viruses. We never found, unfortunately, that either precautions or proselyting had any effect. The pattern was the same for weeks. The female butterflies kept on, day after day, efficiently laying endless clutches of eggs. In due course the eggs hatched. Finally, at varying ages, the caterpillars developed grotesquely bent spines, went off their food, prolonged the time between molts, suffered various other symptoms, all unpleasant, and eventually died. Jane Kinne and

Susan Allan, who were rearing the broods that year, performed minor miracles of devotion and ingenuity — and still the ungrateful beasts curled up and expired. Some mornings, after a specially fatal night, the atmosphere among the human beings in the Caterpillar Room would have been appropriate to the losing team in the World Series.

Finally, last year, the Surinam field trip was repeated. This time we managed to rear 15 adults from the eggs, including, to our rejoicing, several well-defined varieties with extra red. Eight of the

15 were, for various reasons, failures as founders of dynasties. For example, spiders killed Connie and Fernando, and Nellie's eggs were infertile. But four females — Pamela, Eve, Hedi and Bertha — were placed in separate cages, and mated to three of the males — Maharajah, Sam and Dennis-the-Menace. The latter was named by one of his admiring attendants because he not only possessed more red markings than any of the others but flew about with special verve.

These seven butterflies formed the nucleus of all of the season's breeding stock. From them and their descendants, plus several crosses of their progeny with normal Trinidad individuals, we secured three more generations. Between February and July, 35 females laid a total of 2,767 eggs. And from those eggs we reared to maturity a total of 788 adults.

From all this material have come our preliminary answers. Briefly, when a normal butterfly is paired with an individual with extra red markings, about three-quarters of the offspring also

Butterfly cages of many sizes and styles dot the rear garden at the laboratory and all are in constant use by Miss Crane.

Russ Kinne Photo

One butterfly house contains a tropical garden, varied enough to provide food and egg-laying vines for any species studied.

Natica Waterbury Photo



have extra red. In other words, more red in the pattern is always dominant to less red, in ratios that emerge according to basic rules of genetics. When both parents have the dominant extra red, the young theoretically all would have the additional red, and the jungles would soon be full of practically scarlet butterflies. This is not the case, our preliminary conclusions show, because the young of such gaudily colored parents are few and sickly, and one after another they come to unproductive ends.

While caterpillars are famous for turning into butterflies, it has seemed to us lately that nobody yet has given any of them enough credit for its looks, equipment and performance as a caterpillar. We have been watching, tending and worrying over these larvae now for some years, and we never stop being surprised.

Until two seasons ago, we were so engrossed in the adult butterflies that we viewed the caterpillars merely as the inevitable precursors of our winged pets. We housed them in the individual glass dishes they required, fed them passion vine leaves of the proper species and finally gave them wire netting or green leaves upon which to hang themselves as chrysalids.

Recently, however, we have been working with the immature stages themselves, fitting a com-

parative study of their anatomy into the general survey of the group.

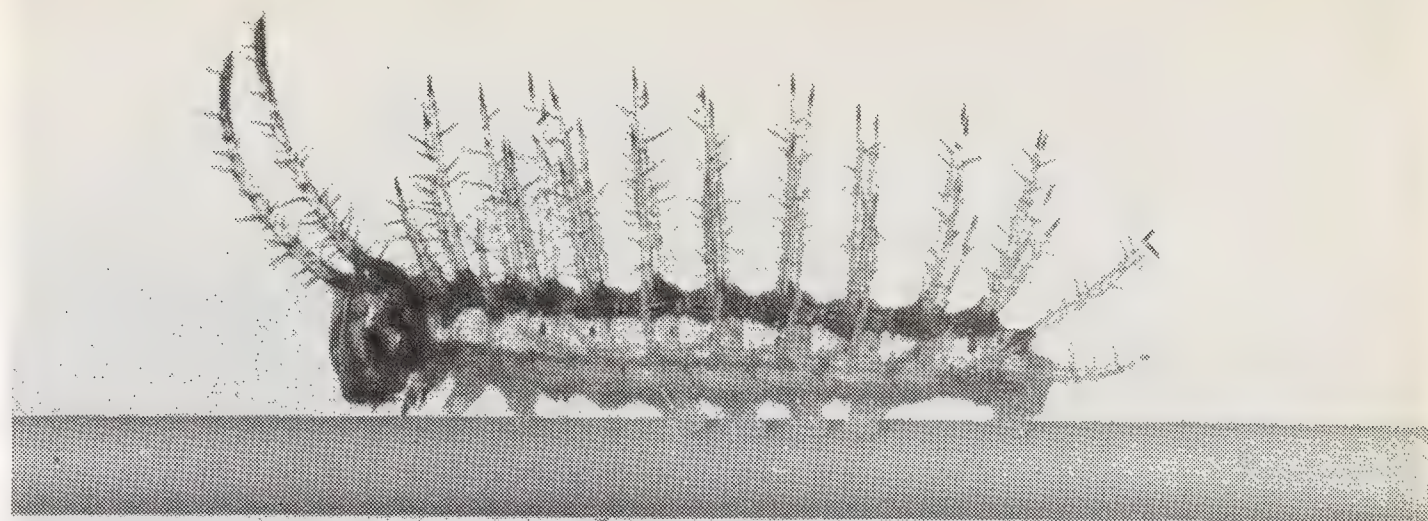
We were amused and impressed every time we looked at a caterpillar under the microscope. Every one of our fourteen species had a kind of carnival flamboyance. It showed in the mask-like markings on their faces, and in their bright and varied patterns; some were striped or polka-dotted in black and white and orange, and all bristled with black spines.

Simultaneously, Anne Alexander started work on their behavior patterns. She found that the species differ as radically in their habits as they do in appearance. Our next job with the larvae will be, accordingly, to tie up such anatomical characters as length of spines with aggressiveness or social behavior or defense. For instance, Dr. Alexander noticed, as she states in an issue of *Zoologica* now in press, that two of the species strike at intruders on their leaves with their long head spines. Meanwhile our studies of spines showed that these are the two species with the longest head spines in the group in relation to their size. We now must sort out in detail relationships among degrees of unpalatability, gregariousness and spine length.

It is probably just as well for the progress of our scientific study that the caterpillar tenders



during these recent crowded seasons — Jane Kinne, Connie Carter, Frances Gibson and Susan Allan — have all been devoted to their charges. Because a roomful of caterpillars can be, and usually is, a nuisance, especially when almost every larva must be kept isolated from all others, in its



Left — During genetics studies 547 larvae were tended in the caterpillar rearing room at one time. Above — a full-grown caterpillar rests on its dinner — a passion leaf vine. The white object is a wad of damp cotton to provide moisture. Top — This caterpillar of *Heliconius alipha*, about $\frac{3}{4}$ in. long, uses its spines to prod other caterpillars. Below — White areas indicate color (red) variation in *H. melpomene*.

Russ Kinne Photos. Drawings by Frances Waite Gibson

own dish, complete with air conditioning and food. It must in fact be fed and cleaned daily, and sometimes more often.

At our time of greatest expansion, which was in the final weeks of the work on polymorphic broods, we had 547 caterpillars in the laboratory. As many as 32 eggs hatched in a single morning and on more than one evening we gathered more than 40 eggs from the butterfly houses, each snipped carefully with fine scissors from a leaf.

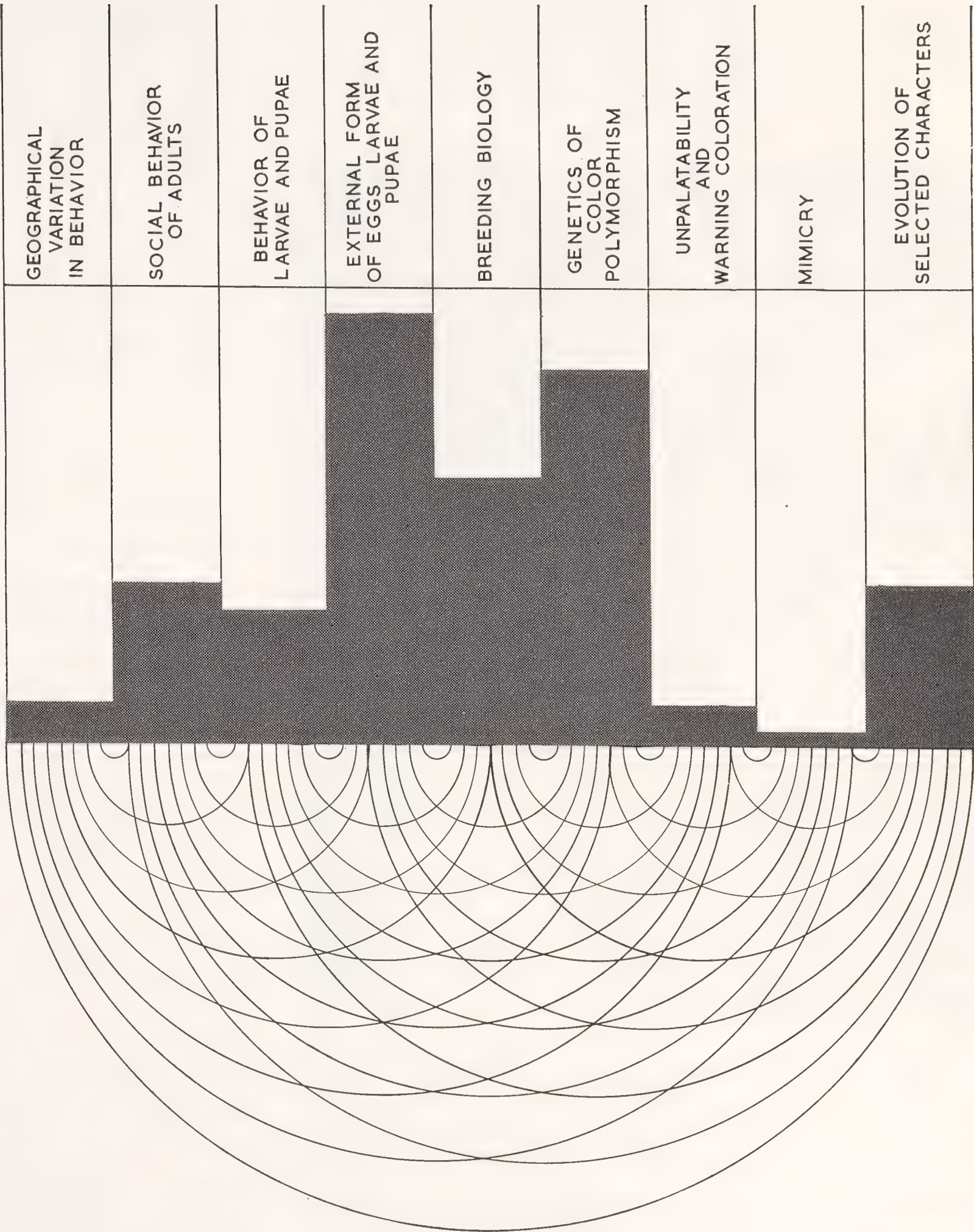
All of this work entailed the collecting, chiefly by field assistant Roodal Ramlal, of about 130 passion vine leaves a day, graduated in size and tenderness, depending on the size and species of larvae to be fed. A young larva given too tough a leaf could gnaw ineffectually and suffer malnutrition; on the other hand, the largest larvae apparently have physiological need for old and fibrous leaves.

If the diagram on page 40 looks more like an intricately connected chain of firecrackers than the statement of a scientific problem, perhaps that is all to the good, since an absorbing piece of research often has a kind of psychological crackle about it that seems a bit like an old-fashioned Fourth of July. The figure shows the nine phases of the helicon problem that concern us the most. Simultaneously, it reminds us of the manifold interconnections within the group, where progress on one front inevitably influences and is influenced by progress, or the lack of it, in each of



A COMPARATIVE STUDY OF FOURTEEN SPECIES OF
HELICONIINE BUTTERFLIES IN TRINIDAD AND SURINAM

The relative advancement of the projected work in nine aspects of the helicon butterfly study is indicated in this diagram. The interlocking semicircles suggest the relationship of each phase of the work to every other phase. Progress, or the lack of it, in one area inevitably affects the advance of the other aspects.
Drawing by Julie C. Emsley



the others. The height of the firecrackers — or smokestacks, if you will — merely gives an arbitrary estimate of the relative amount of progress we have made in each of the fields up to now. By the time this piece goes into print, we hope and believe that most of the smokestacks will be higher. There is, of course, no possibility of putting a tidy scale, climbing to a potential 100%, at the side, to indicate possible progress. Although we naturally hope that all of the relationships will eventually lead to some illuminating starbursts of general knowledge, that happy day will most likely not happen in our time.

In thinking of the edging forward of the various fields, it is pleasant to think, not in terms of fireworks or burgeoning smokestacks, but

rather of an ancient Chinese rug. The kind that comes to mind must always have grown by bits, through years of patient work, with now a road emerging in the pattern, then a bridge, here a bat and there a golden dragon. And in this complex study we feel increasingly the need to follow Haeckel's advice to naturalists, more than a hundred years ago, to ground themselves more thoroughly in philosophy, and especially in logic. More specifically, we are answering the call of that fine English entomologist, Dr. Eltringham. In 1916, after working in somewhat frustrated happiness on dried collections of helicon butterflies, he pleaded for someone to study them alive and at home in the tropics. Well, we are doing our best.

"TEEN-AGE" PROBLEMS IN THE WILDERNESS

By MARGARET ALTMANN

*Moose & Elk Researcher,
Jackson Hole Biological Research Station*

THERE IS A GREAT DEAL OF TALK nowadays about the behavior problems of human teen-agers as a group that neither meets the standards of adults nor fits into child behavior patterns, and so it might be helpful to raise the question of whether this is exclusively a problem of human society or whether we find the roots of teen-age troubles in the world of animals.

My long-range studies on wild, free-ranging game animals have revealed certain things about the role of the juvenile in nature. These observations were made on the western slopes of the Continental Divide, and human interference with the animals was strictly avoided.

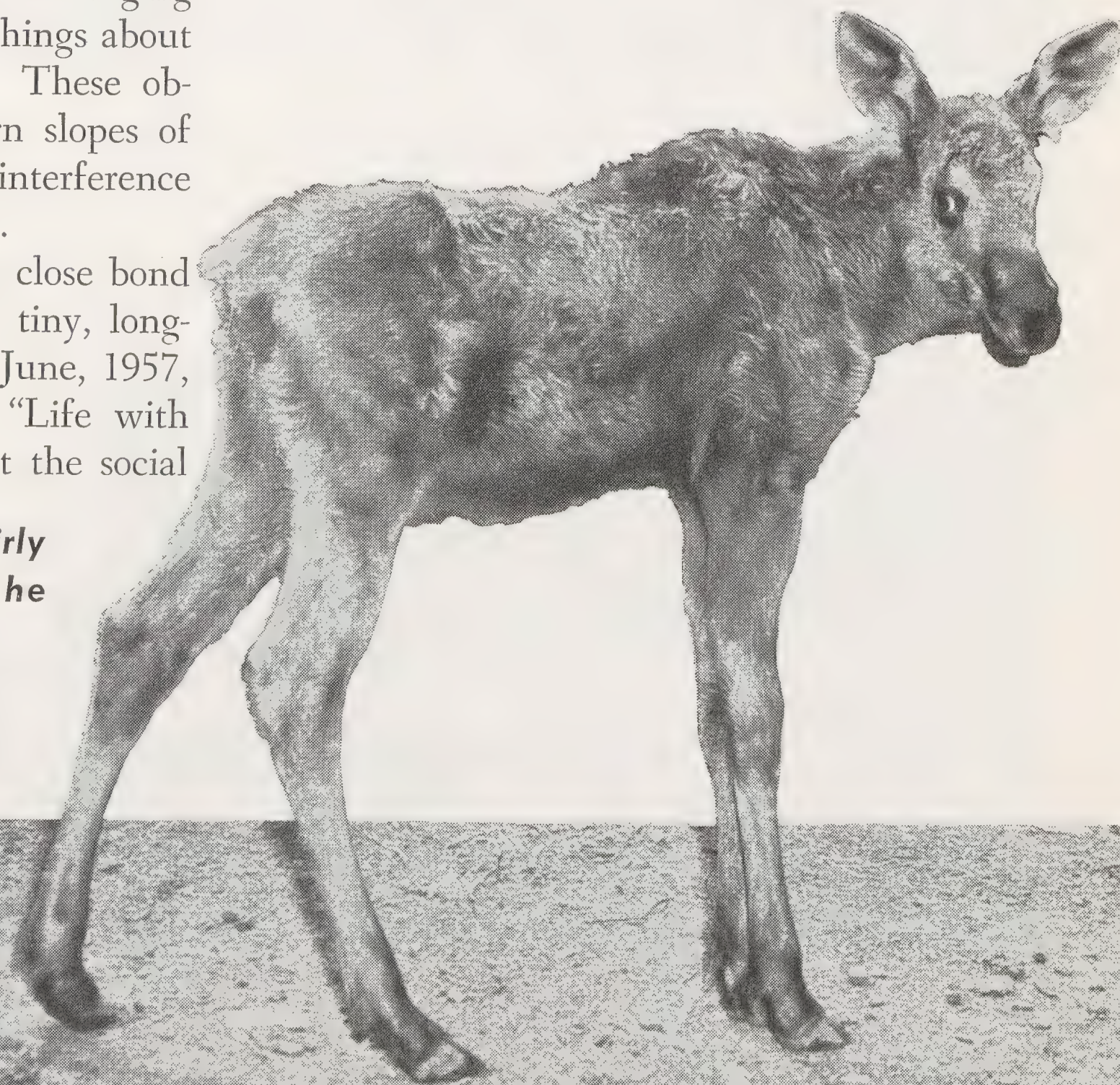
A few years ago I reported on the close bond between the mother Moose and her tiny, long-legged calf, in an article in the May-June, 1957, issue of *Animal Kingdom* entitled "Life with Mother." Let us now take a look at the social

life of the juveniles, the yearling Moose and Elk in the wilderness area of Wyoming's swamps and mountain slopes.

The yearling Moose has to undergo a tremendously trying change in its life pattern. In early spring, about two weeks before the new calf is born, the previously friendly and attentive mother suddenly becomes hostile to the yearling.

First by her gestures, and then if necessary by actually enforced action — by striking with the front hooves — the cow drives the juvenile away from her. No other animal I know can express hostility or even unfriendliness more clearly than a Moose. The cow lifts her long face, drops her ears downward and backward and close to her head, and chews violently, gnashing her teeth so that saliva foam appears. Her expression as she looks at the yearling from the corner of her eyes is unmistakable and it indicates "Go away . . . or else!" The yearling understands, all right; it immediately yields and flees but after a short interval it tries to return. When its attempts to return to the side of its mother are repeatedly frustrated, the yearling appears to be under heavy

The life of a young Moose is fairly uncomplicated at this early age; he has a close bond with his mother. But life changes radically when he becomes a yearling outcast.





stress. For the time being it abandons its usual activities and wanders aimlessly. Obviously, although six months or more have passed since it was weaned, it is still inadequate to manage its daily life alone, independent of its mother. The actual feeding is not a problem, but the selection of a feeding site, the daily routine of choosing a satisfactory place for rest and sleep, the many details of timing and location and, last but not least, the contact with other Moose and the consequent security, present definite difficulties at this point. In all wild game the very young ani-

The Moose cow and her teenager are still together but the relationship will break abruptly just before a new calf is born.

Photo by the author

This is a satellite situation — a big bull Moose has a teen-age Moose as a companion. Old bulls may be tolerant, even friendly.

Photo by the author

By this general posture a Moose cow expresses anger and aggressiveness and her yearling knows exactly what she means.

Photo by Dr. Dixie Smith



mals rank socially with their mothers. This "adult" preferred rank is lost when the juvenile fends for itself. It suddenly ranks low, and every encounter with another animal, even another Moose, becomes a risk and a humiliating experience.

The juvenile Moose finds various solutions for its dilemma. The most frequent way out is a "life in the margin," or partial return to its dam. The yearling stays at a distance but within sight or hearing of its mother, far enough not to be chased but close enough to get cues of impending movements and activities from the dam. This distance is found by each juvenile by trial and error, but once established it seems to work rather well. In the course of the summer, when the cow's new calf is getting stronger, there can be

though this solution brings a break with the familiar habitat and type of security, it offers definite advantages compared to the fourth and last solution — for the juvenile Moose to strike out and live alone.

There is no question but that personality differences in these teen-age individuals, and not solely the environmental situation, help in determining which of these various solutions will be accepted. In some cases I observed that juveniles tried several solutions in succession.

It takes weeks or even months before the teen-age Moose is accustomed to separation from its dam, and more hardship and upheaval are in store for the poor juvenile with the progress of summer into fall. The mating season of Moose starts in September and the early shadows of the



a gradual shortening of the marginal distance for the juvenile, although in no case a complete return.

Another solution found by teen-age Moose is the search for a substitute attachment, usually to an older bull. We call this a satellite attachment, because the teen-ager moves in the dependent position of a follower. The bigger bull Moose determine when and where to go; they show, in fact, a surprising amount of tolerance and even friendliness toward the young satellites, waiting for them when obstacles delay them and tussling with them and shielding them when strange Moose appear.

The third way out of this teen-age crisis is the formation of a juvenile band of several yearlings and two-year-olds roaming on their own. Al-

social unrest connected with it bring a new and intensified crisis for the young Moose.

In order to understand this situation, we must visualize the highly dramatic social picture of the Moose during the rutting season. Each mating group consists of one bull Moose and one cow. The cow may have her young calf by her side, but any other Moose, male or female, is not tolerated within sight or hearing. The mature bull will threaten any other male, most of all a teen-age upstart, and if he finds any hesitation or resistance he uses his heavy antlers to drive the intruder out. A teen-age bull lives in continuous fear and caution during this period. Even his satellite relationship with a previously friendly and trusted older bull comes to a sudden end. Tentative sparring by the older Moose be-

comes more frequent and by the end of August the fights are severe and brutal. With the ending of the satellite relationship, the juvenile has to flee.

But young males are not the only ones with problems; the female Moose teen-ager also has difficulties. It is jealousy over the bull Moose which causes hostility and actual fighting among the cows, and so the female yearling living "in the margin" near her mother encounters this hostility and must leave the area, carefully avoiding the trails of other adult Moose groups. Twin calves, when they reach the yearling crisis of being driven off by their mother, often stay together and thus ease the burden of strange environment.

The result of these crisscross persecutions is a bewildered and erratic life for the teen-age Moose. The first manifestations of a beginning sex drive in these juveniles are all but lost in the turmoil of being driven away and in constantly yielding to social domination.

Let us see how the Elk (Wapiti) juveniles fare in the social grouping of their elders.

Elk cows are also tender and attentive mothers. They have, however, a different pattern of motherly care from that of the Moose cow. They live in herds and so the herd becomes a second home for the yearling while the cow is producing a new calf. The Elk cow, too, drives the teen-ager from her side and does not tolerate its close approach to her new calf, but the herd offers a "place of belonging" to the juveniles throughout the ensuing months.

The Elk's fall mating season reshuffles the big cow nursery groups into harems of five to fifteen Elk, which are joined by a harem bull, and this is when the young male Elk, the "spikes," have their time of hardship.

After a flareup of sex drive and courtship behavior during the pre-rut, when they squeal and kick and try to bugle although their voices are still juvenile, they are faced with the scorn and fighting spirit of the big bulls.

This is serious and dangerous business. There are two main categories of bulls—the harem owners, the most formidable bosses; and the roaming bachelor Elk, a sneaky sort of pretenders, often hidden in dense undergrowth but always ready to intrude and fight.

Both types of bull Elk keep the spikes on the

run. The erratic wanderings of the teen-age bull Elk are not so much determined by the wish to go someplace as by the necessity of avoiding the big bulls. No wonder that the spikes turn up in the least expected or suitable places. In their confusion and bewilderment they do not hesitate to walk on a busy highway or into firing lines of hunters, which all other Elk know enough to avoid; they may even wander into motels or village squares.

I once had an escort of two spike Elk for three miles while riding with my packstring along the headwaters of the Snake River. Since none of us looked or smelled like a bull Elk, and no one bugled, the spikes felt quite safe in marching along behind the packhorses.

As little or no antagonism is shown by Elk cows against other females, the female yearling can remain in the herd group even during the rutting season. These yearlings do not manifest any erratic or foolish behavior.

Observation of the erratic behavior of teen-age groups of Moose and Elk forces us to conclude that it is mainly frustration and non-acceptance by their own group which causes the peculiar behavior pattern of non-conformity.

High mortality and relatively lowered vitality in the teen-age bracket are the results of these hardships. Nevertheless we find that a large number of juveniles achieve a gradual and eventually successfully integration into their species pattern.

Of course, any interpretation of the selective value of the teen-age difficulties has to be made with great caution. Also the tempting analogy with special behavior patterns in human teenagers will have to wait until considerably more facts on variability and causes of non-conforming behavior in animals are known. It does seem, however, that careful case histories and further observations on wild, unrestrained individuals and animal groups may lead to better understanding of the forces causing "normal" and abnormal behavior.

As for now, presenting the picture in bold strokes, we may clearly recognize that the in-between group of the yearlings among wild game animals has problems of social acceptance, and reacts to these difficulties with erratic, non-conforming behavior.

Hair-trigger Mousetrap with Teeth—

THE LEAST WEASEL

By WILLIAM BRIDGES

Curator of Publications



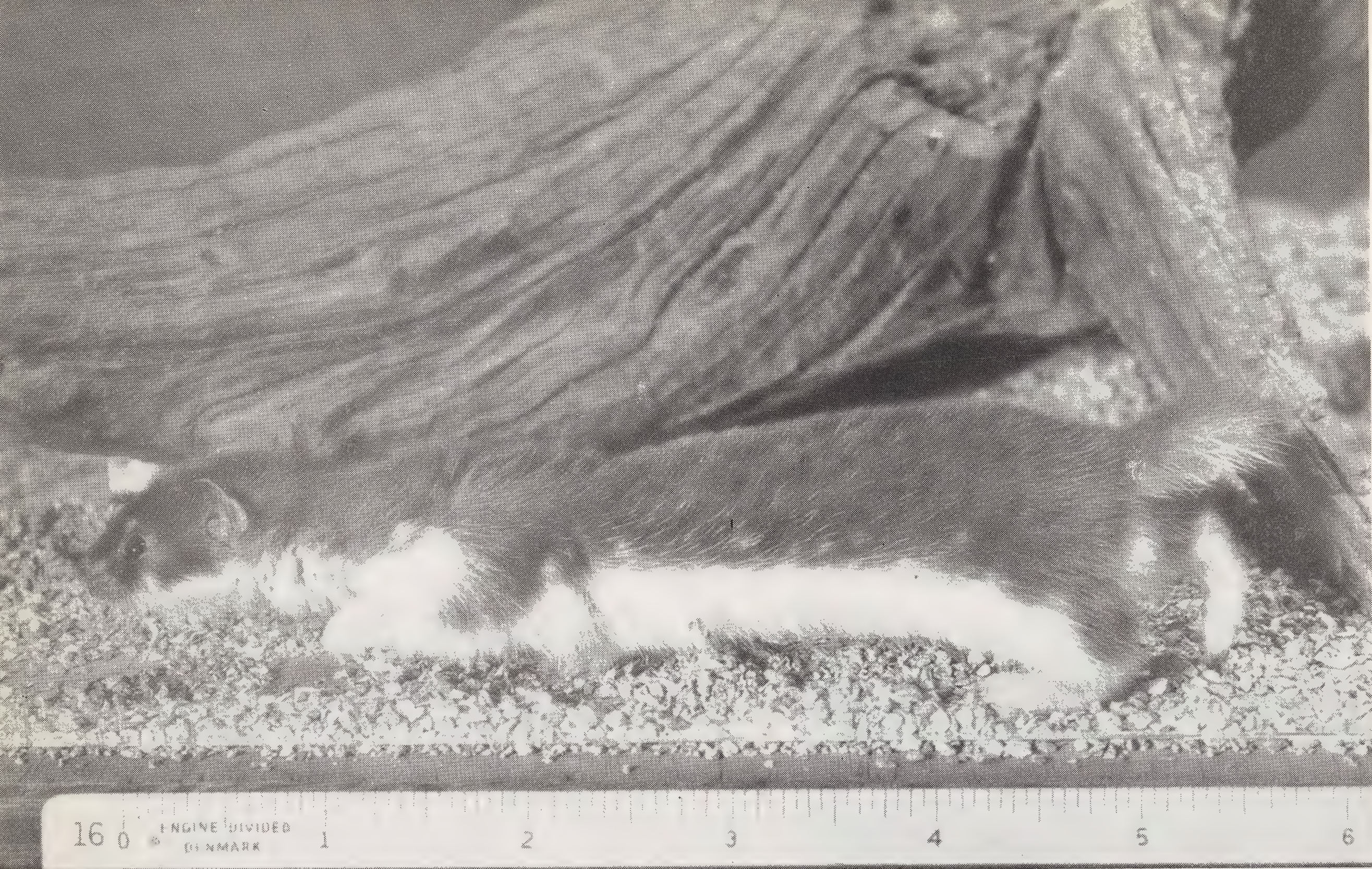
ONE WAY TO DESCRIBE a Least Weasel is to liken it to a hair-trigger snap mousetrap — a mousetrap with teeth, curiosity and aggressiveness. Nobody handles a Least Weasel or any weasel, even with leather gloves, but you have the impression that if you did, it would simply explode into fragments of nervous energy. (Actually it would probably die of excitement-induced shock.)

Later this spring, if we can get an air conditioner installed in one section of the Small Mammal House, visitors will be able to see the first specimen of the Least Weasel we have ever exhibited. Ours is one of the more northerly of the four forms (*Mustela rixosa rixosa*), ranging over most of Canada, and it likes temperatures somewhat lower than we can normally provide in the Small Mammal House. It came to us from the Alberta Game Farm in Edmonton, Alberta.

For the moment we do not know the sex of the little killer, but suspect that it is a female, since females are smaller than the males and ours is only 5¾ inches long, whereas males are said to be as much as 9 inches long.

Least Weasels have an enormous range, starting down in the Alleghenies, covering the Great Lakes States and virtually all of Canada, right up through Alaska (where the subspecies is appropriately known as *Mustela rixosa eskimo*). Apparently they are not common anywhere; in any event they are wary and hard to trap, so that they are seldom seen in collections. Individuals from

Our Least Weasel rears to look over a log, in a typical weasel gesture, before darting forward like a brown-and-white bullet. This picture is enlarged somewhat more than life size.



Its motion stopped by a high-speed flash, the Least Weasel is stretched full length beside a ruler, showing that it is about 5 $\frac{3}{4}$ inches long. This picture is made to the same scale.

the northern part of the range are supposed to turn white in winter (except for a few black hairs in the tip of the very short tail), but ours remained brown above and white beneath. Least Weasels have one color peculiarity; unlike any other weasel, their fur gives off a purplish fluorescence under ultraviolet light.

Victor H. Cahalane, who writes entertainingly about the weasels in his "Mammals of North America," remarks that "The weasel is the most bloodthirsty of all the mammals." Once it starts killing — in a poultry yard, for instance — it seemingly cannot stop, and one is known to have killed forty fowls in one night. On the other hand, not all weasels are habitual chicken-killers, and mice, rats, rabbits, squirrels, young birds, even snakes, frogs, lizards and insects are probably their commonest fare. As mouse and rat killers, alone, a weasel qualifies as a pretty good animal citizen. It is likely that even a Least Weasel could and would kill a rat, an animal much bigger and heavier than itself. Watching our Least Weasel threaten a hand momentarily

introduced into its cage for cleaning or placement of food, you are quite willing to believe that it has the courage to tackle almost any foe.

Weasel attack strategy is dictated by its "nose-mindedness" in hunting. When the scent has led it close to its prey, it makes a rush that generally overwhelms the victim in a tangle of limbs and lithe body; a fraction of a second later the weasel has bitten through the back of the neck or a vein and has begun to drink the blood. That, however, is only an appetizer; it appeases its hunger with the flesh of its prey. Our Least Weasel, incidentally, is thriving on horsemeat and when on one occasion it was offered a mouse (dead), the mouse was sniffed and disdained. Weasels seldom touch carrion except meat they have carried into their own burrows.

The weasel is not a do-it-yourself builder of his home; rats and prairie dogs and other naturally burrowing animals (the weasel's victims, in fact) dig the burrows and the weasel appropriates them. Construction of a nest lined with fur or feathers is about as far as a weasel goes in housekeeping details. Ours has not been provided with a tunnel, but it does have a gnarled log in its cage, and behind this, and partly beneath it, the little animal has made a snug retreat out of shredded tow, which we provided.

ANIMAL NEWS IN PICTURES

PHOTOGRAPHS
BY
SAM DUNTON



The rate of growth of the big snakes is always a matter of general interest and periodically the Reptile Department has been weighing and measuring its largest specimens. These are two scenes from the day-long wrestling match on March 7 when the Reptile House keepers (with a tail-hold assist from the Mammal Department) measured and weighed its big pythons and largest crocodilians. This **AFRICAN ROCK PYTHON**, father of a brood hatched in 1960, was 12 feet 11 inches long and weighed 88 pounds.





For a good many years there has been no shortage of **DINGOS**, or Australian Wild Dogs in the Zoological Park — fifty have been born to the pair we received from Tarōnga Zoo in Sydney in 1954. The six shown here are from a litter of eight born January 1; a male and a female are being reared separately for future exhibition and breeding.

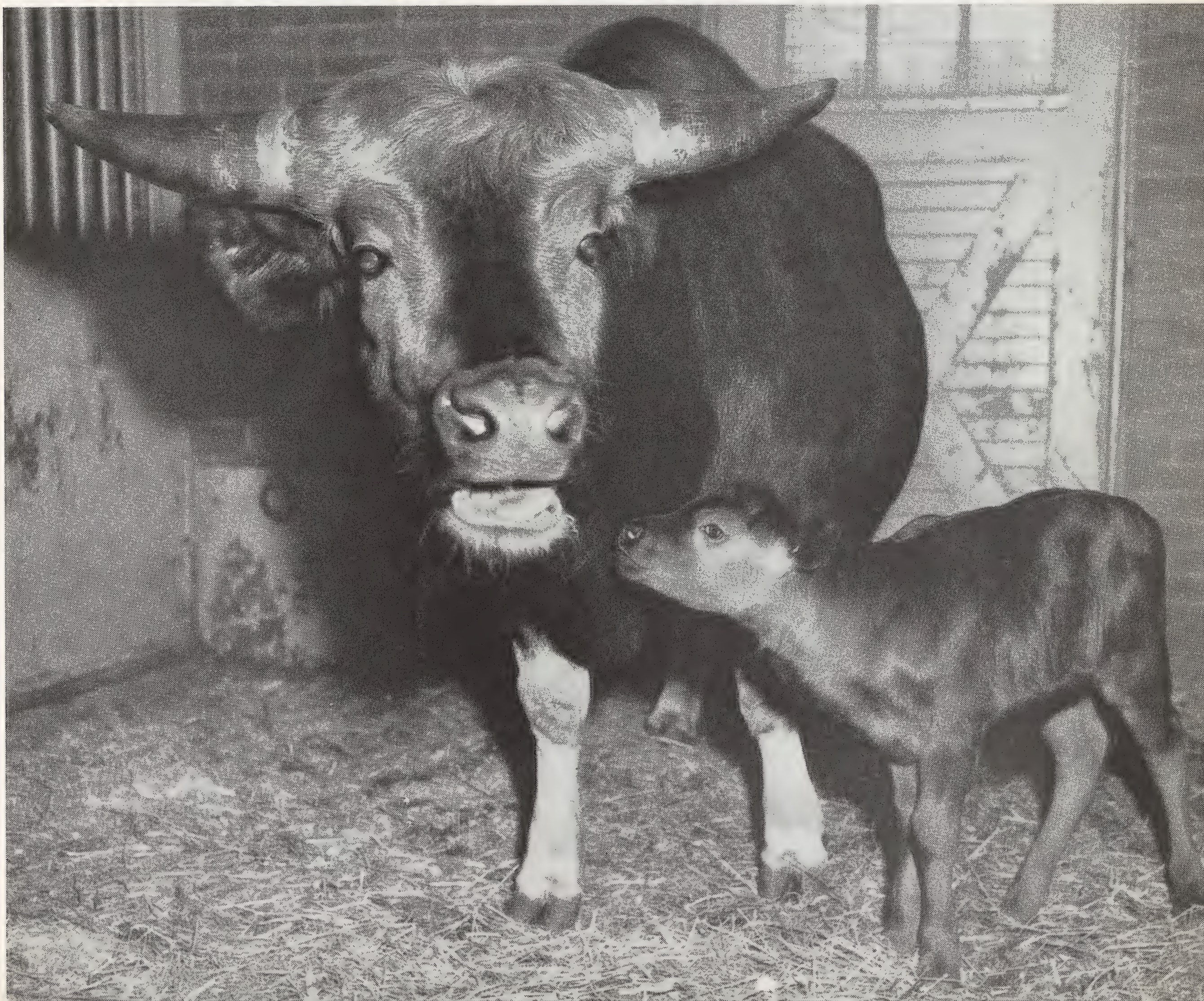


The **FAT DORMOUSE** of southern Europe is also known as the Edible Dormouse, for it appears to have been relished by the Romans. We have six, but they are for exhibition, not eating; we are now training them to sleep at night and stay awake in the daytime. They will eventually be shown under red light in a special series of exhibits being created in part of the Small Mammal House.

This is a full-length picture of a **SEA ANEMONE** of the species whose "blossom" appears on the cover of this magazine. The animal lives in the tube, which it secretes itself and which has a texture rather like felt. In nature the tube stands upright in sand or mud; this one is 28 in. long. Several specimens recently came to the Aquarium from the Mediterranean and they are thriving.



The **GAYAL** from the hilly districts of northeastern India is an imposing animal that looks as if it might be a very tough customer at close range — that is, until you get near enough to notice its placid bovine eyes and gentle ways. There are no wild Gayals, and it is said to be "a domesticated Gaur." We have a pair, both born in the Zoological Park, and on March 6 they produced this female calf. It was unsteady at first but Keeper Reilley managed to hold it up for a first nursing and now it is doing very well on its own.



How Birds Leave the Nest

By ALEXANDER F. SKUTCH

San Isidro del General, Costa Rica

*Ink and Water color illustrations
by Don R. Eckelberry*

ANYONE WHO UNDERTAKES to follow the activities of a pair of nesting birds until their offspring become self-supporting sees much of interest and beauty. But perhaps the most exciting event in the history of the family is the departure of the young from the nest. This is, indeed, the climax of the whole fascinating drama. It is the moment of triumph for the parents, who by the exercise of diligence and caution have brought their eggs and chicks through many perils to which neighboring nests may have succumbed. To reach maturity, the young must still escape many dangers, but they are not so likely to be lost all together as while they lay in a helpless cluster in the nest.

The young birds are commonly divided into two groups by the circumstances of their development. In one are those (precocial, or nidifugous) which, like domestic chickens, are covered



with down when they hatch, and leave the nest before they receive food; in the other (altricial, or nidicolous) are the birds which escape the eggshell in a less developed state and must, for a week or more and sometimes for months, be fed and protected in the nest by their parents. No sharp dividing line can be drawn between these two groups, which are joined by transitional forms, yet on the whole this is a useful classification.

Let us begin with a species in the first group. In Costa Rica I studied a Marbled Wood-Quail's nest which was situated on the ground in tropical forest and roofed with dead leaves and twigs. The hen alone incubated the four white eggs, taking

each day a single outing which began around sunrise and lasted between one and a half and three hours. Her mate came every morning to call her from the nest, and at the end of her excursion he escorted her back to it, but he always prudently stopped short some yards away, thereby diminishing the probability of revealing its exact position to hostile eyes.

The four eggs hatched in the interval between the hen's return from her recess at half-past eight on one morning and the following dawn. On this day the mother lingered in her nest well past her usual hour for departure, while her mate, who had come for her at sunrise, moved impatiently through the undergrowth and called with growing insistence. At last the hen answered softly and increased his suppressed excitement. Then, with more low murmuring, she rose and pushed half-way through her doorway. The chicks, whose soft, variegated down was already dry, needed no urging to come forth. One pushed out beneath her while she hesitated in the entrance. When at last she stepped forth, four chubby creatures tumbled out around her. As she slowly advanced to join her partner, they followed with short runs punctuated by brief pauses. Her way led across a long, low, decaying log, which opposed a formidable barrier to chicks who had escaped from their shells less than twenty-two hours earlier. Three soon managed to scramble over and their mother led them off, while the father returned to encourage the weakest one until it, too, found a place where it could surmount the obstacle. Then all vanished into the dark undergrowth of the forest.

The majority of chicks which leave the nest early are hatched in nests on or near the ground or close above water, so that they may easily walk or swim away. But in a number of species, including some of the guans of tropical America, and a few ducks, they are hatched well above the ground, either in an open nest or in a cavity in a tree. How do these chicks, without flight feath-

ers on their stubby wings, manage to reach the earth? One might suppose that the parent would carry them down, perhaps in its bill, one at a time. But few birds seem able to transport their young. The downy chicks simply jump from their nest; they are so light and fluffy that their apparently reckless plunge is rarely fatal.

In Iowa, Frederic Leopold watched many broods of Wood Ducks jump, on the day after hatching, from high nest-boxes in response to their mother's call, and he never knew a duckling to be disabled. Sometimes one struck the ground so hard that it bounced up a few inches and was momentarily stunned, but soon it recovered sufficiently to follow its mother. These amazingly hardy ducklings were then led down a steep bluff a hundred and thirty feet high, across a railroad track, and over a stretch of the Missis-



Left — The Groove-billed Ani. Right — The nest of an ani. These are gregarious birds; even in their nesting they are social, and several females may lay in the same nest. In this particular nest, the eight eggs were laid by two females and all parents helped in incubating.



The Yellow-bellied Elaenia is a small tropical Flycatcher and one of those (in the nidicolous group) whose young require more or less prolonged parental care in the nest.

issippi River the better part of a mile in extent, which they covered in about twenty minutes, swimming close behind the duck.

Intermediate between the two groups of birds are some of the goatsuckers, whose young at hatching are well covered with soft down, but unlike the downy chicks of gallinaceous birds cannot follow their parents and pick up their own food. The parents feed them by regurgitation, much in the fashion of hummingbirds. The Pauraque of tropical America lays two eggs on fallen leaves in the shade of a thicket, and if undisturbed the downy young may remain for days in or near the spot where they hatched. But if molested, as when one sets up a blind and tries to watch them from it, a parent settles down some yards away and utters a peculiar, soft call, which brings chicks only a day old hopping toward it, overcoming obstacles seemingly insuperable by such tiny creatures. Pushing valiantly onward, at last they nestle once more beneath the warm feathers of their father or mother.

Some members of the cuckoo family are also

intermediate between the two groups. The anis, lanky black birds with long tails and high-arched bills, construct bulky open nests of sticks which are often the work of several pairs. The eggs of the pairs are laid in a single heap and incubated by all the male and female parents in turn, and the young are reared as a single family. Newly hatched anis are blind and naked, but their development is amazingly rapid. If disturbed when they are less than a week old but already bristling with long pinfeathers, they scramble out of their shallow nests and climb away through the close-set boughs of the supporting bush or tree, often hooking their bills over a twig to avoid a fall. At times they drop to the ground. When all is quiet

they return, if they can, to their nest, where they are fed and brooded by the parents like any helpless nestling. Similarly, fuzzy young Hoatzins, whose nests of sticks are placed in bushes above the margins of South American rivers and lagoons, dive into the water when danger threatens. They return to the nest when it has passed, climbing by means of feet and bill and claw-like fingers at the bend of each wing, as Dr. William Beebe has so graphically described.

Birds that require more or less prolonged care in the nest (the true nidicolous group) include practically all the songbirds, pigeons, herons, hawks, hummingbirds and nearly all those birds which breed in holes and burrows, such as woodpeckers, trogons, toucans, kingfishers and motmots. If undisturbed, the young of these diurnal birds most frequently leave their nests in the forenoon, when they are most energetic and active. Yet they may do so at any time of day, and once I watched a seventeen-day-old Yellow-bellied Elaenia, a small tropical flycatcher, make its exit on an afternoon of long-continued, drenching rain. It did this by climbing up among the close-set leaves of the supporting branch until it was well above its nest, and there it fell asleep in the rainy dusk. Presumably it left at this unusual hour because its downy nest had become sodden and uncomfortable.

Birds that grow up in open nests have ample opportunity to stretch and exercise their wings before they take their first flight. One may see young hummingbirds standing in their downy nest and beating their well-feathered wings into a haze, clinging with their feet to avoid being carried off. Many nestlings rest on their nest's rim, or even venture a few inches beyond it over the surrounding boughs, then return to their familiar home. Rarely they take longer excursions, only to rejoin their nestmates who have stayed behind. But my impression is that the majority of true nidicolous birds never sever contact with their nest until the final leave-taking, and then do not return to it save in those relatively few species which use the nest as a dormitory — certain woodpeckers, swallows, wrens, and other birds.

Young birds reared in open nests are not only able to exercise their wings before they entrust themselves to them, but their nests are usually closely surrounded by vegetation, so that their first flight need not be long. Those which grow up in holes and burrows frequently lack space to exercise or even fully expand their feathered wings, and moreover their doorway often faces the empty air high above the earth or else a wide expanse of open water, so that a weak, inexperienced fluttering from the nest would be disastrous to them, and their first flight must necessarily be strong and long. To witness the emergence of one of these birds is highly dramatic, especially when one reflects that its safety depends on the efficient performance of an activity which it never had an opportunity to practice.

One morning, soon after sunrise, I saw a young Ringed Kingfisher come to the mouth of his long burrow in the bank of a Guatemalan river. For a while he rested there, gazing across the broad stream which sparkled in the sun's earliest rays. At intervals he bobbed his head up and down and uttered a loud rattle. Then suddenly he launched forth, turned downstream, and rose to perch in a willow tree. I estimated that his first flight carried him two hundred feet, with a rise of about forty — not a bad performance for a bird who had passed all his days in the dark earth, unable to exercise his wings.

This kingfisher took the decisive step spontaneously, while his parents were out of sight.

This is nearly always the way with altricial birds: if undisturbed, they leave the nest in response to their own growing strength and need of activity; they require no more parental urging to come forth from the nest than at an earlier stage they needed to make them peck their way out of the eggshell. But as the time for their departure draws near, they are in a state of unstable equilibrium and the slightest stimulus may set off their flight, just as the gentlest touch will cause the sudden opening of some explosive seed-pod, like that of the jewel-weed, which without interference would burst open ten minutes later. While I watched two young Violet-headed Hummingbirds in their downy nest above a rushing Costa Rican stream, a small, harmless flycatcher flitted past and caused one of them to fly out. Half an hour later, its nestmate did likewise, quite spontaneously. But it is otherwise when danger seems to threaten the young. Thus when a man approaches a nest, especially if the parents are at hand, the excitement of the latter, their calls of alarm, may stimulate the youngsters to jump out and flutter away several days before they would otherwise have left.

Violet-headed Hummingbirds — male on the left and female on the right. The author saw young leave the nest when a flycatcher passed.



There are numerous accounts of parent birds coaxing or luring their reluctant or timid young from the nest, often by withholding food from them. Since I have from concealment, or from a good distance, watched the departure of many young birds, from kingfishers and trogons to tanagers and finches, yet have never witnessed a successful attempt of unalarmed parents to persuade fledglings to leave, I am skeptical about the interpretation of some of these episodes. Apparently, in some of these cases, the observer's presence excited the parents, which would greatly alter the course of events.

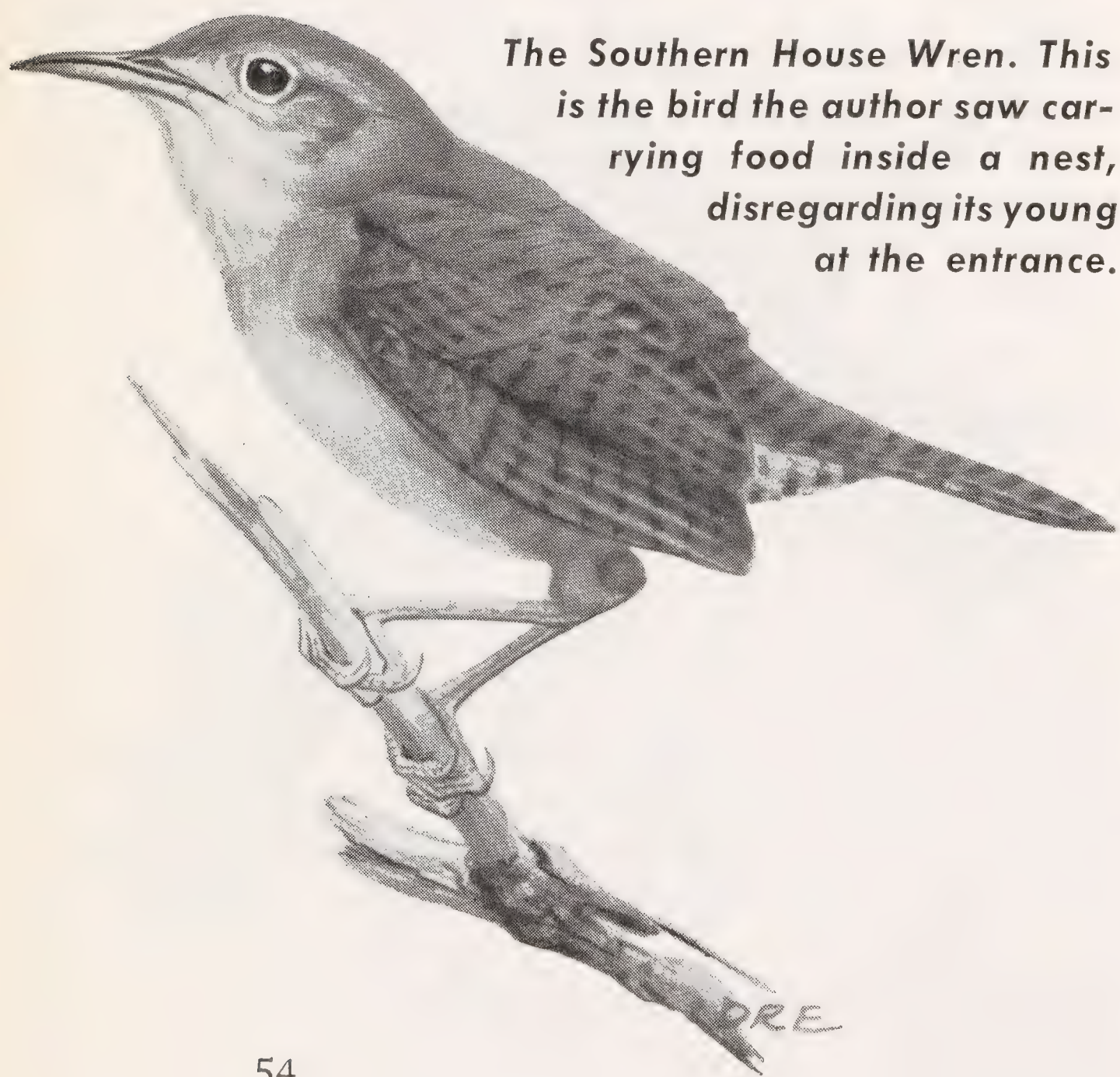
How difficult the interpretation of birds' behavior can be was impressed upon me some years ago while I watched a burrow of a Rufous-tailed Jacamar, a starling-sized bird with a long, sharp bill and plumage that glitters like that of a hummingbird. When the first nestling came to the mouth of the tunnel in a bank, its mother, approaching with a dragonfly, twice hovered in the air in front of it, then flew off without delivering the food. This may have been an attempt to lure the youngster from the burrow; but more probably the parent did not deliver the dragonfly simply because the fledgling was now filling the mouth of the tunnel and left her no place to alight. The next meal that the parents brought was taken to the stay-at-home rather than to the

fledgling who meanwhile had come forth, and this seemed to indicate that it was indifferent to them whether their youngsters stayed in the nest or emerged.

Similarly, I have seen Southern House Wrens, on coming with food, push past a fledgling who was at the entrance of the nest box, on the point of departure, and take the morsel to another inside, probably because the one halfway through the opening was in a position where it could not conveniently be fed. After the first of three young Black-crowned Tityras left their nest in an old Woodpecker hole, high in a branchless trunk on a steep mountainside, the parents seemed eager to bring the other two into the open. But all their coaxing in front of the hole was of no avail. The three youngsters left on three consecutive mornings, all at very nearly the same hour, and this regularity in the time of their departure was to me convincing evidence that they took the decisive step in response to inner prompting.

Although it is by no means the usual way, some parent birds do tempt their young with food to leave the nest, and in a few species this may be customary procedure. Colonel Meinertzhagen published a vivid account of how parent Ospreys at a Swedish lake displayed food to their nestlings from a distance, until the latter were forced by hunger to fly from the nest and receive it. Mrs. M. K. Rowan reported that it was the regular practice of the Redwinged Starlings who nested on her porch in South Africa to withhold food from their young when the time for their departure was at hand. When one brood, which had clung to the nest longer than usual, failed to respond to this enticement, the father lost patience and proceeded forcibly to evict the fledglings. Despite his mate's effort to shield her offspring from his rough treatment, he lifted two of them bodily out of the nest and dropped them on the floor of the verandah. Then he pecked and pushed them over the edge of the high perch into the sheltering vegetation of the garden. No comparable instance of forcible expulsion from the nest has come to my attention. In my experience, parent birds lead or lure to a safe place fledglings who have already ventured forth, far more often than they try to make them leave the nest.

The Southern House Wren. This is the bird the author saw carrying food inside a nest, disregarding its young at the entrance.



EYES AT THE EDGE OF TWO ELEMENTS



By JAMES W. ATZ

Associate Curator, New York Aquarium

FROGS AND FISHES are strikingly different kinds of creatures, and even people not particularly interested in natural history feel confident that they could tell one from the other without any difficulty. The Aquarium now has on exhibition, however, a fish that is regularly mistaken for a frog. Over and over again, visitors exclaim, "Oh, look at the little frog!" Then, after reading the label, they say, in a tone full of wonder — and often incredulity as well — "It's not a frog. It's a fish. The sign says so." Despite our carefully worded labels, we suspect that some visitors are not quite convinced.

The Mudskipper seems to spend more time out of water than in it. When on land, it rests on its two pelvic or ventral fins and "rows" itself along with its fleshy-based pectorals.

Lilo Hess Photo

What makes this reaction particularly remarkable is that the fish really isn't very frog-like at all. It has an elongate, fish-shaped body with a fully developed tail, and all its appendages are fins, not legs with feet and toes. Only one small part of it resembles a frog, but here the similarity is so striking that it overshadows all other features of the animal's anatomy.

The fish is the mudskipper, and its eyes are what fool people into taking it for a frog. Instead of being more or less disc-like or flattened hemispheres located on either side of the head, its eyes are perched up on top in a pair of rounded pro-



The eyes of the Mudskipper give its head a superficially frog-like look. They are adapted for vision in air rather than water, as are the eyes of the frog, but unlike the frog eye, they can be rotated in the horizontal plane.

tuberances. They are so like the well known bulging eyes of frogs and they are so prominently displayed that the observer gets the immediate impression he is looking at a frog and doesn't bother to look any further, especially when the fish is resting out of water, as it habitually does. Mudskippers inhabit marine or brackish tidal mudflats and mangrove swamps where they seem to spend most of their time hopping about, either in pursuit of small insects, crabs and the like or in keeping other mudskippers at a distance. The fish is said to be agile enough to catch insects on the wing, but whether or not this is so, there is not the slightest doubt about its ability to capture small prey moving along the ground — like a frog, except that it lacks a frog's prehensile tongue.

Like a frog, the mudskipper must be able to see small objects accurately in order to feed the way it does. Quite naturally the question arises whether there is any connection between the similarities in structure and function of the protruding eyes of the two kinds of animals. The fish's eyes show one advantage over the frog's in that they can be rotated, a nice compensation for the lack of a neck and the ability to turn the head. (This faculty is responsible for the mudskipper's

Like most frogs, the Green Frog remains at the water surface for long periods. With its elevated eyes, it observes what takes place above water while remaining hidden below.





The Hippopotamus spends its days submerged in African rivers or lakes, protected from the tropical sun, but at night it leaves the water to forage. These scenes are from the Congo.

Institut des Parcs Nationaux du Congo Belge: H. de Saeger Photo

scientific name, *Periophthalmus*, from the Greek words, *peri* meaning around and *ophthalmus* meaning eye). Like the frog's eye, the eye of the mudskipper is shaped and its parts arranged so that it functions better in air than in water.

Other animals also have similarly protruding eyes, most notably the hippopotamus, a few salamanders and turtles, and the crocodilians, that is, the crocodiles, alligators and caimans. Although related to one another in only the most distant fashion, they are all amphibious like the frog and the mudskipper, and while they may not be equally at home on land or in the water, they can get around reasonably well in or on both. Moreover, in nature, all of them, except salamanders and



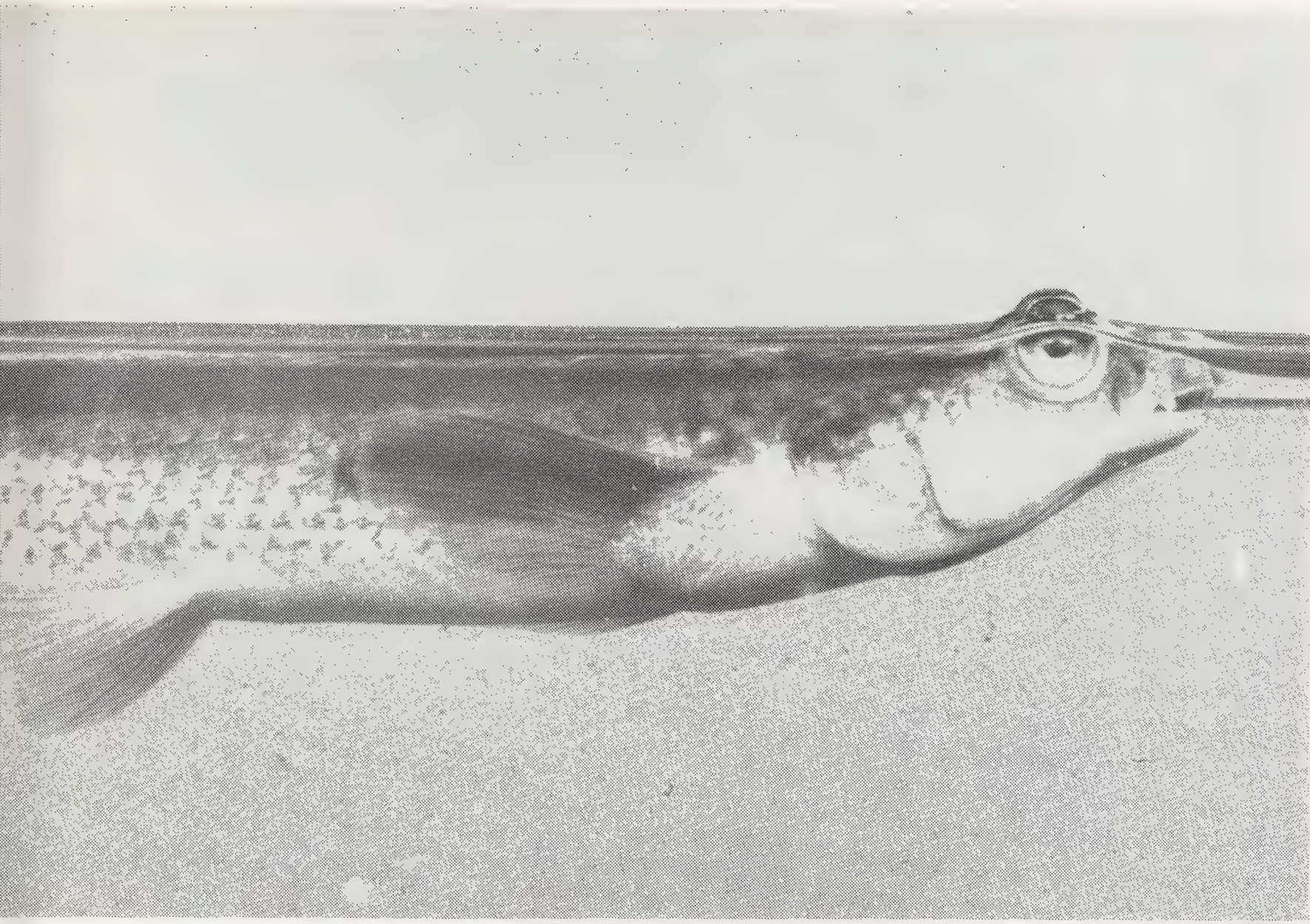
the mudskipper, spend a good deal of time at the surface with their eyes out of water and most of the rest of their bodies submerged. Since the eyes of all of them, except perhaps some of the salamanders, are primarily constructed for vision in air, their location at the top of the head enables them to remain in the element in which they function most efficiently, to make the animal

aware of food or enemies while it enjoys the comfort and protection of the water.

Zoologists have a special term for a situation like this in which unrelated animals show similar structures that are associated with a similar mode of life. They call it *convergence*. This is an important concept because it enables zoologists whose job is the classification of animals to avoid errors such as the one made by our visitors. Although professional zoologists have never classified the mudskipper with the frogs, they did at one time, for example, consider whales to be fishes, mostly because they have fins instead of limbs — another good example of *convergence*.

The eyes of Hilary's Sideneck Turtle are elevated more than in many turtles, including the marine species. Such eyes have apparently not evolved in the sea because of the waves.





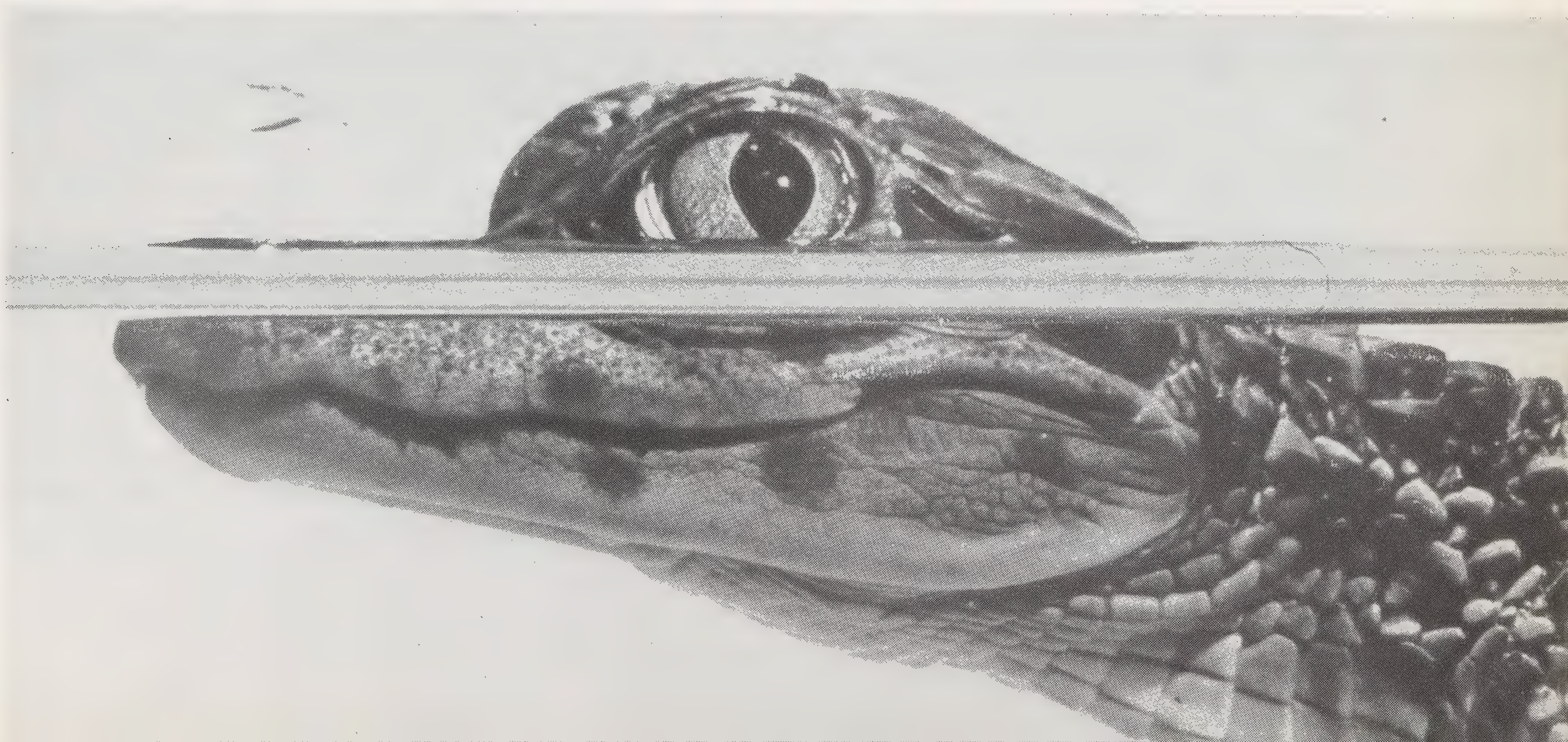
Swimming at the surface of the water with its eyes just half submerged, this South American Four-eyed Fish is able to see above and below water simultaneously.

The simplest explanation for convergence is natural selection, which Darwin was the first to point out. Animals that inhabit similar environments become modified in similar ways because environments select similar advantageous modifications.

Sharing the tank with the Aquarium's mudskippers, is another, unrelated, species of fish that has the same sort of protruding, frog-like eyes. Although, strictly speaking, it is not amphibious because it does not leave the water to travel on land, it nevertheless spends almost all of its time at the surface with half of its eyes out of water. Half of the eye is adjusted for vision in air, the remainder for vision in water. The pupil is divided into an upper and a lower part, and the fish

habitually swims so that the water surface lies exactly at the level of the horizontal separation between the two pupillary openings. From this, the fish gets its popular, descriptive but not quite accurate name, four-eyed fish. By means of this ingenious arrangement, the four-eyed fish can see sharply in both air and water *at the same time*. In the hippopotamus, frog and crocodile, the eye is arranged so that it can remain in one element while the body occupies another. In the four-eyed fish, the eye itself occupies both elements at once.

Crocodylians characteristically float just beneath the surface with only eyes and nostrils showing, as in this young Spectacled Caiman.



News from the Conservation Foundation

Allagash Region Project

The Allagash River, long known as providing an outstanding wilderness canoe trip through the spruce-fir and maple-beech-birch forests of northern Maine, is the heart of the Allagash region, the subject of a new study now under way by The Conservation Foundation on behalf of the Natural Resources Council, Incorporated, of Maine.

Made possible by the generous gift of Mr. David Rockefeller, supplemented by donations from members of the Maine Natural Resources Council and others interested in the Allagash problem, this project will investigate issues involved in the future development, organization and management of the Allagash region. In recent months, proposals involving development of a highway, a hydroelectric dam and additional recreational facilities by government agencies have been publicized. The purpose of the study is to place these various land use proposals in perspective, particularly as they may alter the wilderness character of the Allagash region.

The alternative proposals regarding land use in the Allagash region arise as a natural consequence of increasing pressures for recreation, power, pulp and wood products not only in Maine but throughout the nation. Land in the region is undergoing more rapid development and change than has been experienced in several decades.

Student Program to Continue

Five years ago our organization helped to initiate the Student Conservation Program, an idea suggested to us by its original director, Elizabeth Cushman Titus. It provided opportunities for qualified high school and college students to work as assistants to Park personnel in National Parks, and for four years it was developed with notable success. Recently the National Parks Association indicated that the program would have to be suspended during the summer of 1961. However, it has now been announced by the National Parks Service that because of its enthusiasm for

the program, Park personnel facilities will be made available and it will be officially sponsored by the National Parks Service for continuance in the current year. It will assume the new title of "National Park Service Student Conservation Program." Work will be concentrated in the Olympic and Grand Teton National Parks and a few students will also be enrolled at Zion National Park and at Cedar Breaks National Monument. It is gratifying to report that this valuable activity will continue this summer.

Further information may be obtained from the Student Program, Room 922, 50 Rockefeller Plaza, New York 20, N. Y.

Briefly Noted

Fairfield Osborn appeared as guest on "The House We Live In" television series, broadcast by WCAU-TV, Philadelphia, on February 17. Dr. Osborn discussed the problem of natural resources and the population explosion with Professor Ian McHarg of the University of Pennsylvania . . . Stephen Blodgett and Roger Hale represented the Foundation at the 26th North American Wildlife and Natural Resources Conference in Washington, D. C., March 6-8. . . . A Water Research Symposium, sponsored by the National Reclamation Association and the National Association of Soil Conservation Districts, was attended by Wallace Bowman on March 28-30, in Washington, D. C. . . . The first 1961 meeting of the Conservation and Management of Natural Resources Committee of the National Association of Manufacturers, New York City, was held on February 24. Belmont Pitkin attended the meeting and served on its Water Resources Sub-Committee. . . . During February Foundation members served as a pre-screening committee for the 1961 American Film Festival, reviewing films in the category of Wildlife and Natural Resources . . . Martha Munzer, speaking before an open meeting of the Riverdale Garden Club on March 16, pointed out the values of preserving remaining natural areas in the local community.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Night-into-Day Reversal of Animals Succeeding

Nocturnal animals are among the most interesting and at the same time the least successful zoological exhibits. For the most part they are mere balls of fur, breathing gently in profound sleep, during the hours when visitors are in the Zoo. Only the night watchman sees them leaping, running, prowling and feeding — carrying on the active phase of their lives.

Attempts to reverse the activity cycle have been made in many zoological parks for many years and have met with considerable success. We are now resuming our own work along these lines on a rather large scale; the entire northwest tier of compartments in the Small Mammal House is being converted into a reversal exhibit. The first animals tested, a pair of Moholi Galagos, reversed their normal activity cycles in three and six days, respectively. They are now awake and lively during the hours when the Park is open and they sleep through the night.

This was accomplished by flooding the test compartment with bright white light during the night, and illuminating it with red light during the day. The animals have readily adjusted to sleeping in their log shelter at night, under the bright light, and all day long they are almost continually active, exploring their compartment and making graceful, sure-footed leaps from the floor to perches several feet overhead. One in particular likes to leap to the wire grating of a ventilator in the ceiling, hanging upside down and twisting its neck in seemingly impossible positions to watch visitors — going through extraordinary bodily contortions as it leaps down and turns to land on its feet.

The eyes of nocturnal animals are barely, if at all, sensitive to red light, so that while the animals are quite visible to the human eye, they are in subjective darkness during the red-lighted "night" period. A good deal of experimentation has been done to determine the optimum levels

of the white and red lights and the red level is now perfectly satisfactory for easy viewing by the normal human eye — and it is apparently quite satisfactory to the animals, too.

Creation of the red wing in the Small Mammal House, including redesigning of several of the compartments, will occupy a good part of the spring and the building is temporarily closed. It will be reopened on Members' Day, June 7, if not before.

Aquarium Asked for Diagnosis of Rainbow Trout Disease

Fish culturists in the western United States discovered a year ago that many of the Rainbow Trout in their hatcheries were suffering from a liver disease that seemed to be an epidemic form of cancer. Because of his extensive experience with fish tumors of all kinds and because he had made studies of this disease as far back as 1954, Dr. Ross F. Nigrelli, the Aquarium's pathologist, was called in to help diagnose it and to recommend corrective measures. He has attended a number of meetings called urgently to deal with the situation, the last of which was an inspection tour in March of state, federal and private hatcheries in the Snake River region of Idaho. It is here that millions of Rainbow Trout are grown each year for stocking sport fishing streams and for marketing in food stores and restaurants.

Part 1 of *Zoologica*, the Zoological Society's technical journal, contains an article that describes in detail the diseased livers of Rainbow Trout. In preparing this analysis, Dr. Nigrelli and Dr. Sophie Jakowska, a Research Associate at the Aquarium, examined the livers of more than 300 fish. As a result of this comprehensive survey, they were able to show that most of the so-called hepatomas were not cancerous growths at all. They also gave good evidence that the disease very likely has its origins in an unfortunate combination of hereditary predisposition and improper diet. — JAMES W. ATZ

Left — Director Koga of the Ueno Zoo in Tokyo presided at a ceremony on Feb. 11 as a Manchurian Crane and two White-necked Cranes were sent to the Bronx Zoo in a "Sister City" exchange between Tokyo and New York. Below — The cranes were received at the Bronx Zoo in a ceremony on Feb. 24. Officials of the Zoological Park, City and Federal Government attended it.



Roger Tory Peterson: Text of Citation

For the record — since these things are often buried in institutional records — we print here the text of the citation read by Dr. Fairfield Osborn, President of the Zoological Society, at the Society's mid-winter Members' Meeting on January 9 in presenting the Society's Gold Medal to Roger Tory Peterson.

The words inscribed on this medal are "Inspired interpreter of birds for the benefit of man." Your career cannot be epitomized so briefly. You have worked arduously and brilliantly since your early youth for the benefit of birds as well as for the benefit of man. You have sensed that although birds could get along without man, the lives of innumerable people in every land are uplifted by the presence of the aerial creatures that you know and love so well.

It is said of you that your passion for birdlife, which you have had since your boyhood, "stemmed from the fact that these winged creatures are symbols of freedom." You have traveled tirelessly to the far reaches of many continents seeking greater knowledge and understanding. Your persistent search for detail of form, color and action and your extraordinary gift of artistry have proved invaluable assets in gaining so full a measure of success in the career to which you have given your thought and your energies.

You are not only one of the preeminent ornithologists of any age, but you are as well a true naturalist and a disciple that sings of the beauty and mysteries of all living things.

Besides Mr. Peterson, the Society's Gold Medal has been presented in past years to William Beebe, Raymond L. Ditmars, Senator Fred Walcott, Jacques-Yves Cousteau, Robert Yerkes, Konrad Lorenz and Rachel Carson.



IN BRIEF

Ookie Improves. Newspaper stories during the winter about the indisposition of Ookie, the young female Walrus at the Aquarium, stirred up great interest and many inquiries have been made by telephone and mail. It can now be reported that the abscesses that developed on her left cheek are disappearing, that her appetite is normal, and her weight now 560 pounds.

Snake Mite Control. After more than two years of experimentation, the Midwest Research Institute has developed for us two chemical substances

which it believes to be highly effective in the control of snake mites—the scourge of reptile collections in most zoological parks. The new compounds, which we are testing under Reptile House conditions, are said to be better than the “Dri-Die” we are now using for mite control. A report on the new chemicals will be made later.

Talks by Dr. Ray. Dr. Carleton Ray of the Aquarium staff addressed the North American Wildlife and Natural Resources Conference in Washington on March 7 on “Marine Reserves for Ecological Research,” and a few days earlier he spoke before the Systematics Discussion Group of the American Museum of Natural History on “Bergmann’s and Allen’s Rules in Poikilotherms.”

Dutch Elm Cotrol. The Dutch Elm disease of elm trees continues its seemingly inexorable march through the Zoological Park. During the past month thirty elms from 8 to 30 inches in diameter had to be taken down and burned, including several on Baird Court.

Five Swan Eggs. Last year our pair of Black-necked Swans began egg-laying out of doors on February 28 and were caught in the heavy snow-storm in early March. This year they started earlier and the first egg was laid on February 26. Five have been laid and we have taken all of them and are incubating them in the basement of the Bird House—a much safer place than the exposed Marsh Garden.

Home Away from Home. During the late stage of construction of a new filter system at the Aquarium, the Oceanic Tank has to be temporarily drained and a Zoological Park pool will therefore be host to two of the Aquarium’s California Sealions.

IN BRIEF

GATHERING OF SHORE BIRDS. By Henry Marion Hall. Edited by Roland C. Clement. Illustrated with 95 line drawings by John Henry Dick. 242 pp. The Devin-Adair Company, New York, 1960. \$10.00.

Like many other natural history publications produced today, this book is a combination of good reading, informative reference and fine art work and layout. The major portion is given over to descriptions of the 57 species of shore birds which have been known to breed on the American continent north of the Panama Canal. Brief accounts under the headings of South American Shore Birds, American Shore Birds in Europe, European



Olaf, the Aquarium’s big Atlantic Walrus, was admired in a photograph at a National Geographic Society exhibition in Washington, D.C.

National Geographic Society Photo

Shore Birds in America, Siberian Shore Birds in America, plus a most useful bibliography, round out the text most satisfactorily. It is a useful addition to the bird-watcher’s bookshelf, although a trifle high in price.—
D. REVILLE

THE GROWTH OF SCIENTIFIC PHYSIOLOGY, PHYSIOLOGICAL METHOD AND THE MECHANIST-VITALIST CONTROVERSY, ILLUSTRATED BY THE PROBLEMS OF RESPIRATION AND ANIMAL HEAT. By G. J. Goodfield. 174 pp. Hutchinson of London (British Book Centre, N. Y.) 1960. 18 shillings (\$4.00).

Any study of the history of science adds a new dimension to one’s understanding and appreciation not only of the particular part of science under consideration but of the scientific method itself. This scholarly book well illustrates the tortuous development of important ideas we now take for granted.

THE MECHANISM OF EVOLUTION. By W. H. Dowdeswell. x + 115 pp., 25 text-figs. Harper Torchbook. Harper & Bros., N. Y. 1960. 95¢.

A concise, well balanced and up-to-date account of what the great majority of today’s biologists believe is the way that evolution takes place. Written for people with a high school knowledge of biology.

CULTURE METHODS FOR INVERTEBRATE ANIMALS. Edited by James G. Needham *et al.* xxxii + 590 pp., 84 text-figs. Dover Publications, Inc., N. Y. 1959. \$2.75.

Not long after this invaluable compendium was first published in 1937, it became one of the most sought-after out-of-print volumes in biology. Now that it has been reprinted, both professional and non-professional zoologists, teachers, scholarship-conscious students, and fanciers with pets that have strange appetites should all rejoice.

KINGDOM OF THE OCTOPUS. By Frank W. Lane. xx + 300 pp., 16 color and 82 black-and-white illus., 13 drawings. Sheridan House, Inc., N. Y. 1960. \$7.50.

No animals have been regarded with greater revulsion, combined with hypnotic fascination, than have the octopus, the squid and their relatives. Greatest of all living animals without backbones, they have the most highly organized nervous system of any invertebrate. They are fantastic, mysterious and, in a few cases, truly terrible, but the author has eschewed sensationalism and has let the facts speak for themselves. This outstanding book covers all aspects of its subject, presents a wonderful collection of illustrations and is provided with a most useful bibliography, glossary and index. — J. W. Atz.

GUIDE TO MARINE FISHES. By Alfred Perlmutter. 431 pp., many figures. New York University Press, N. Y. 1961. \$6.50.

Salt water fishermen and amateur naturalists interested in marine fishes frequently have difficulty identifying their quarry, even with the help of the best guides available. Dr. Perlmutter has now devised a key so simple and clear that people without any training in biology whatsoever can quickly determine what species they have in hand. Included are all the Atlantic coastal fishes occurring from Cape Hatteras to Cape Cod, except for some rare migrants. Information on size, natural history and relation to man is also provided. — J. W. Atz.

PASTEUR AND MODERN SCIENCE. By Rene Dubois. 160 pp., paperback. Doubleday & Co., New York, 1960. 95¢

A well-written, even engrossing, account of Pasteur's life and his place in modern science. The author is on the staff of the Rockefeller Institute.

SCIENCE PROJECTS HANDBOOK. Edited by Shirley Moore. 254 pp., paperback. Science Service, Washington, and Ballantine Books, New York, 1960. 50¢

A useful guide and handbook for young people who want to work up their own science projects and participate in science fairs.

New Members of the New York Zoological Society

Between January 1 and February 28, 1961

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THE EVOLUTION OF MEMBERS' TOURS

Time was when Members' Tours of the Zoo and Aquarium were impromptu, spur-of-the-moment affairs. A Member would just drop in, with family and friends, the Director would appoint a guide, and off the group would go, up hill and down dale, in and out of buildings and behind the scenes.

Delightfully informal and informative as such tours were, one of the disadvantages was that many Members wanting tours had to be disappointed because sometimes Curators were just not available. They were in Ecuador, collecting birds. Or in Africa, taking movies. Or on a fauna survey study in the cypress swamps. Or that was the day when the elephant was due to be moved.

But now we've corralled these elusive Curators and prepared them to expect a group of Members, with their families and a special friend or two, on four Saturday mornings in April, May and June (see schedule below). And we've also provided them with an effective short-range broadcasting apparatus, so that it's easy to hear what they have to say.

We hope you'll plan to attend, bringing with you a friend who may decide to share your interest in the Zoological Society by becoming a Member.

THE SCHEDULE

April 22—Tour of the Bronx Zoo's Reptile House with Curator Herndon Dowling. Is a boa's skin cold and slimy? NO! You'll discover the truth when you have the chance to touch Headkeeper Spencook's favorite snake.

May 6—Associate Director of the Zoo William Conway will don his other hat as Curator of Birds for this occasion and show Members the Zoo's extensive exotic wildfowl. Bring field glasses if possible, but they're not essential.

May 20—You've read in the papers how Mammal Curator Joseph Davis has changed the activity cycle of nocturnal mammals so that they're now active in the daytime and sleep at night. He plans a preview of new exhibits for Members.

May 27—Photographer Sam Dunton is a man of infinite patience and his know-how in photographing animals is unequalled. On this camera safari in the Zoo he intends to help everyone with a camera—from a Leica to a Brownie—get that perfect shot.

June 17—Curators James Atz and Carleton Ray will be delighted to show Members all the new Aquarium exhibits—and, of course, Ookie and Olaf will be there.

Members' Tours start at 10:30 from Members' Room in the Zoo or the main entrance of the Aquarium. Members may bring others in their immediate family, but not more than one guest. There's no need to give advance notice of your coming—just come and enjoy yourself.



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ANIMAL KINGDOM

THE MUSEUM OF NATURAL HISTORY ZOOLOGICAL SOCIETY



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ANIMAL KINGDOM

Bulletin of the
New York
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Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

What Hope for African Animals?

THE SURVIVAL of the wild animals of Africa over the long future is without doubt a critical question. However, the current acute pessimism concerning their ultimate fate is often too extreme and does not take account of some realities. For instance, allowance is not made for the immensity of that continent, whose land area is more than three times greater than that of the United States including Alaska. Within it are remote regions which will continue for many years to be natural sanctuaries where the intrusion of man, the lethal predator, will not be too dangerously felt. But, this hopeful observation is not entirely valid because the extremely rapid increase of populations throughout Africa, if long continued, would ultimately preempt such natural refuges.

The real solution will depend upon the degree that the African people, now that they are attaining self-government, will become committed to wildlife protection. Fortunately, there are a number of hopeful signs that this will happen. For example, the Republic of the Sudan, a government independent since 1955, several months ago commissioned Frank Fraser Darling, Vice-president of our affiliate, The Conservation Foundation, to review existing conservation practices and game ordinances and to prepare a report on wildlife policy. Dr. Darling was assisted on the survey trip by George Merck, Secretary of our Society. A number of other developments of this kind come to mind, such as the expressed policies of the new Tanganyika government, including its specific action in regard to the permanent protection of the Serengeti National Park. The forthcoming meeting of representatives of a dozen or more African governments with conservationists and biologists in Arusha, Tanganyika, this September, will unquestionably give added impetus to the whole cause of wildlife protection throughout the continent. True, there are offsetting critical situations, such as the present acute threat to the National Parks of the Congo, a direct result of the chaotic conditions of the government and economy of that country. Nevertheless, close observers are of the opinion that a definite improvement in official attitudes in several other countries has occurred in the last year or two, the necessary preliminary to more effective protective action.

The New York Zoological Society has been working hard during the last few years to help in every way possible. This magazine contains a special report concerning what we have done. Our institution has a special responsibility which it must continue to meet.

Fairfield Osborn



Vanishing Giants & Enduring Dwarfs

THE TORTOISES

By HERNDON G. DOWLING

Curator of Reptiles

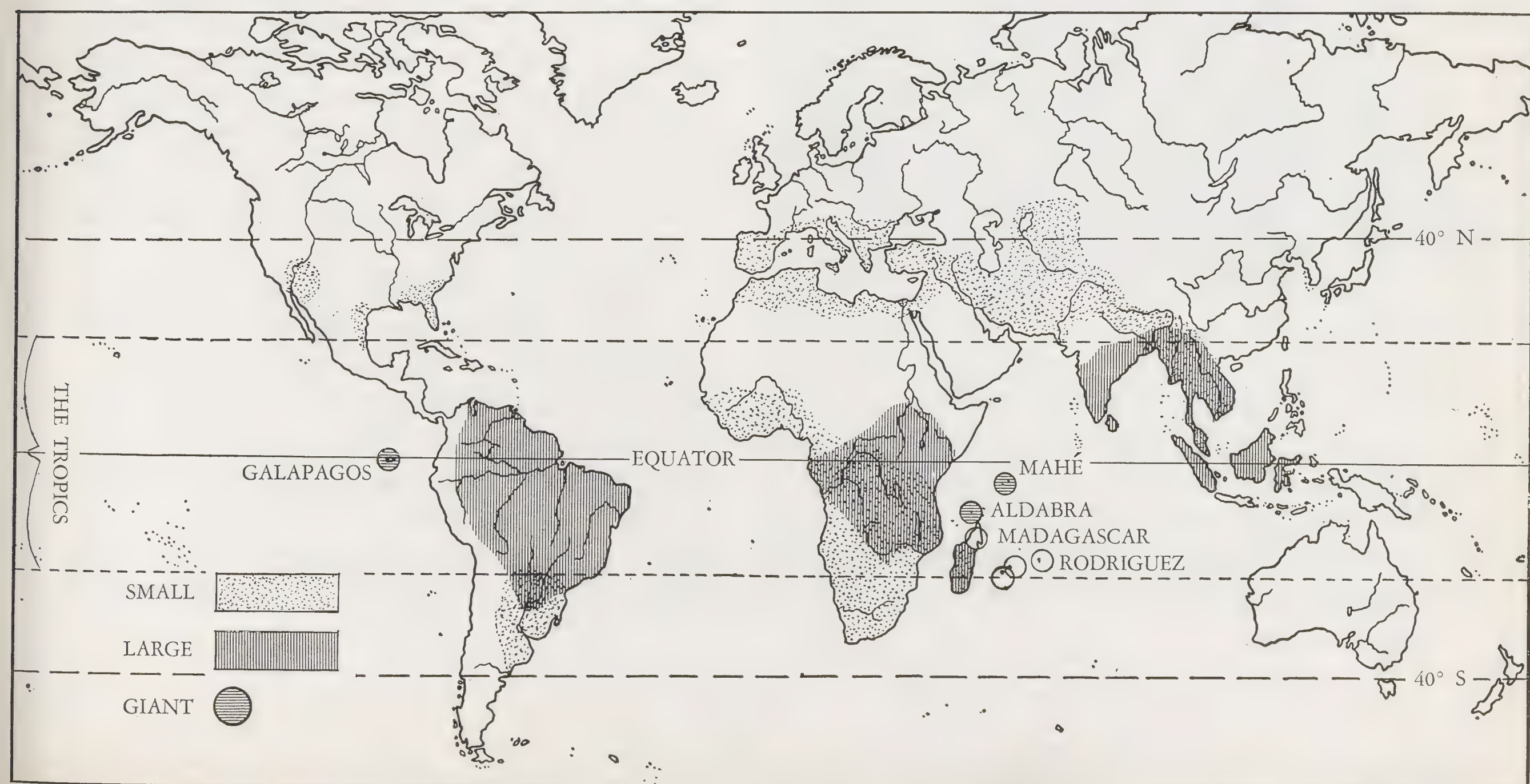
THOSE GROTESQUELY SHAPED, heavy-shielded, and elephantine-limbed terrestrial reptiles called land turtles or tortoises are well known to all of us. Of this group only the Gophers are native to the United States but, nevertheless, the tortoise tribe has been well publicized because of public interest in the giant tortoises of the Galapagos and Aldabra Islands. The last of these giant species are now on the

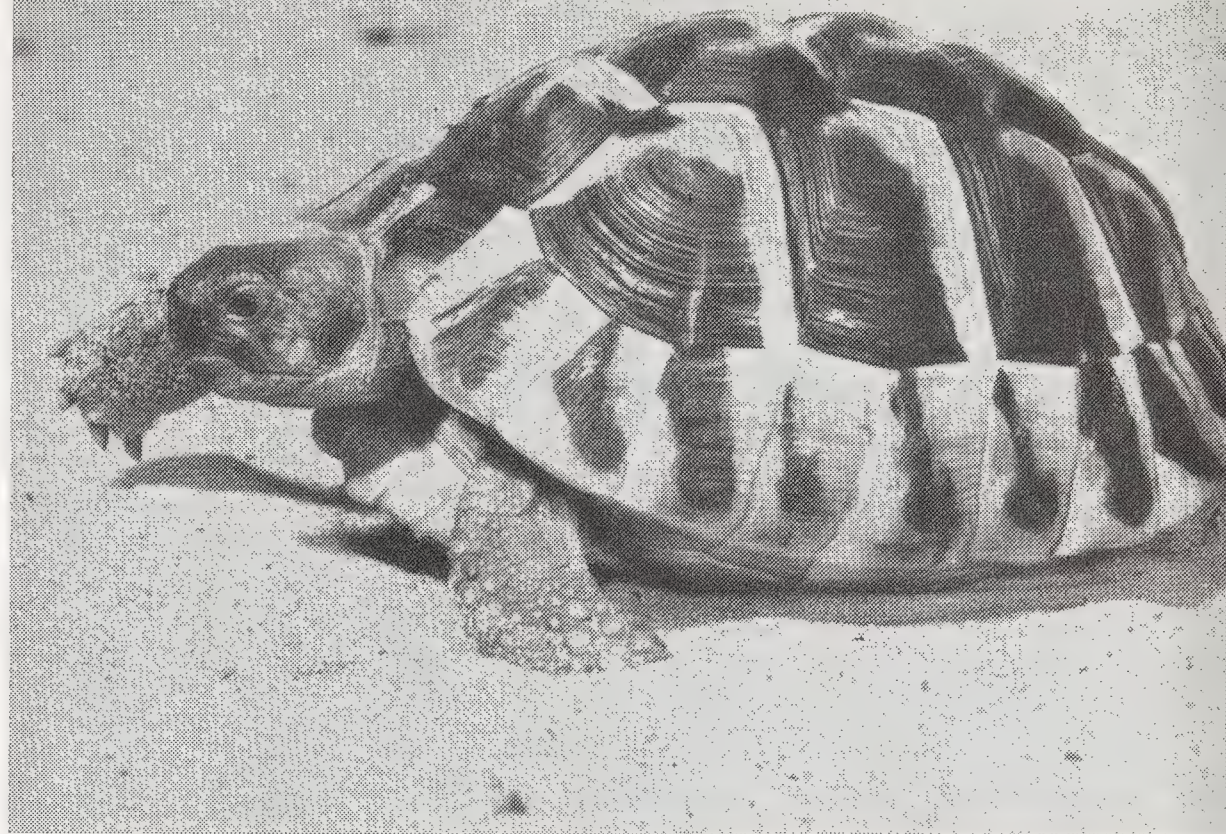
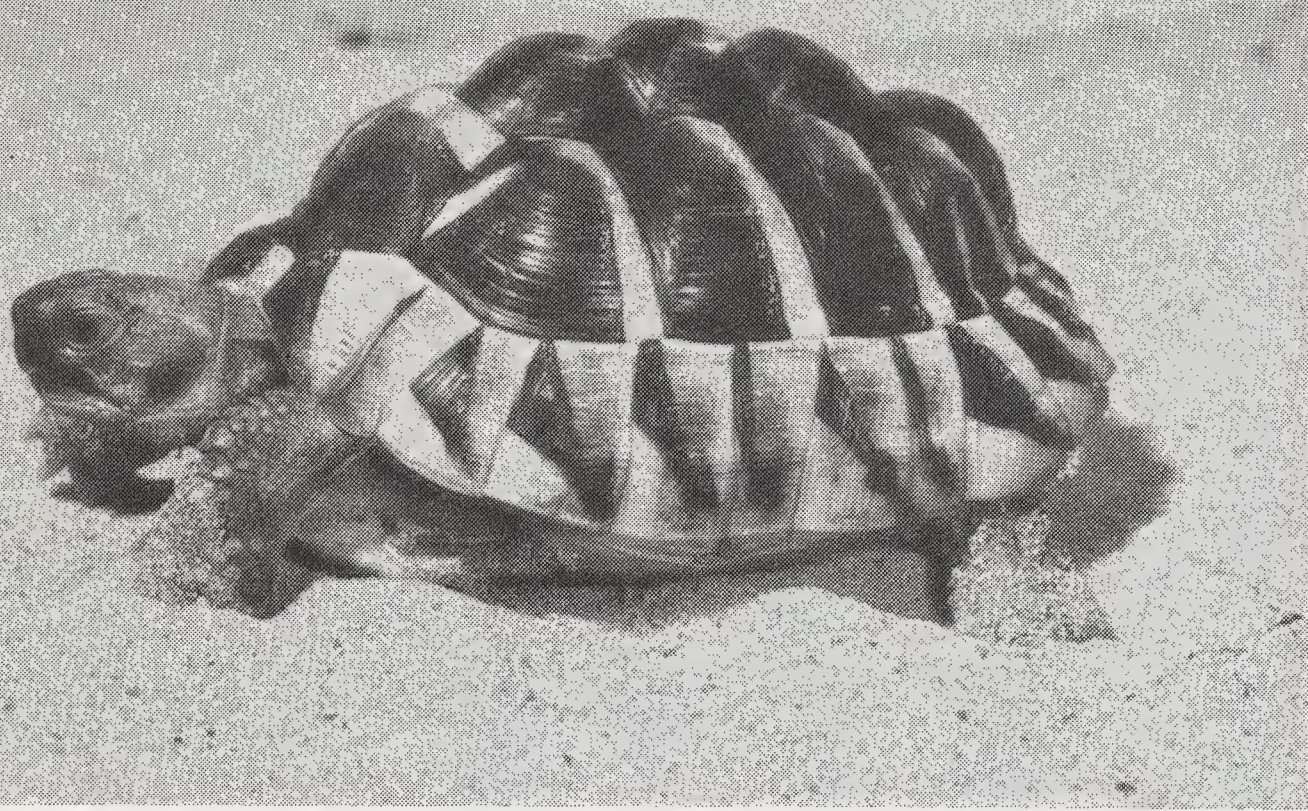
verge of extinction and they may disappear from their native haunts in the present decade. The smaller species, however, appear to be still numerous and many of them, with the advent of cheap air transportation, are being brought to the United States for sale in pet stores.

During the past few months, by gift and by purchase, we added to our collection of tortoises until at year's end we found that we had a greater variety than we had ever before exhibited in the Zoological Park. In this same period, while studying the tortoises that came in, I discovered to my amazement that it was by no means an easy task to identify a member of this small and supposedly well-known group. This was particularly true if the tortoise happened to be a juvenile, or an individual without locality data.

More than that, there would seem to be a major controversy shaping up on the proper names of these animals. I say this after comparing the ideas presented in the most recent world check list of turtles (Mertens & Wermuth, 1955) with those in an even more recent definitive

Left — "Teddy" is the oldest inhabitant of the Zoological Park, a South American Tortoise (*Geochelone denticulata*) who came to us in 1914 from Theodore Roosevelt. Below—Ranges of small tortoises are dotted; larger species (*Geochelone*) vertically shaded. The three shaded spots show island homelands of the three living giant tortoises, while the hollow rings indicate the ranges of those giant tortoises that have been exterminated within historic times.





Left — Moorish Tortoise (*Testudo graeca*) from southern Spain, northern Africa, western Asia and the southeastern Balkans. Right — Hermann's Tortoise (*Testudo hermanni*) from the north-central Mediterranean region. Both species have recently appeared in local pet stores.

work on African turtles (Loveridge & Williams, 1957). The tortoise names in these two authoritative papers differ for almost every species and even the familial relations are the object of some dissension. Such a controversy always leaves the non-specialist (even a snake specialist is not necessarily a turtle specialist these days) in a state of confusion until the last word is said and the final paper written. Museum curators can ordinarily leave the names of their specimens "as is" until the dust settles but zoological park curators are under considerable pressure from the public to name the animals on exhibition — and we prefer to use the *correct* names. So in such cases as this we have to read over the pertinent literature (and often a good deal that is not particularly pertinent), try to bring the various points of view into some sort of agreement, and then decide (sometimes with aid from the flip of a coin) on what names to use. It is true that in the present case the tortoise names may be settled by another paper by Mertens & Wermuth that is now pending. On the other hand it may be a generation before some final settlement is made. Thus the names used here are an interpretation of present ideas and may be changed tomorrow; such are the hazards of biological science. We expect, however, to be able to distinguish the tortoises no matter what their names are.

These land turtles, or tortoises, make up a group known to (some) zoologists as the subfamily Testudininae of the family Testudinidae.

It contains 35 or 40 species (depending on the classifier), thus making it a fairly large segment (about one-fifth) of the turtles now living on this planet. This subfamily has two major components: the large tortoises, in which the adults are from one to three or more feet in length, belong to the genus *Geochelone*; the other component with approximately the same number of species contains the smaller tortoises with adult sizes of one foot or less. It, however, is broken up into no less than nine genera, seven of which are restricted to Africa or Madagascar.

Vegetarians all, the larger species have been subject to man's interest mainly as food. Several former species have become extinct within historic time for this reason and the few remaining giants are on the verge of following them into extinction. Many of the smaller species are brightly colored and all of them are more active and alert than most of the pond turtle group. Thus, they have been much in demand as pets in Europe, and are becoming a standard item of the pet trade in this country.

Thinking of land turtles, most of us would be tempted to place our old friend the Box Turtle (*Terrapene*) with this group. Such an idea would be violently opposed by a turtle taxonomist (a zoologist interested in the relations of these animals), however. He would point out that the smooth skin of the head (rather than scaly plates) and the webs between the toes (even though slight) are enough to show that the Box

Turtle is just a pond turtle gone wrong — a terrestrial member of the pond turtle subfamily Emydinae, not a true tortoise.

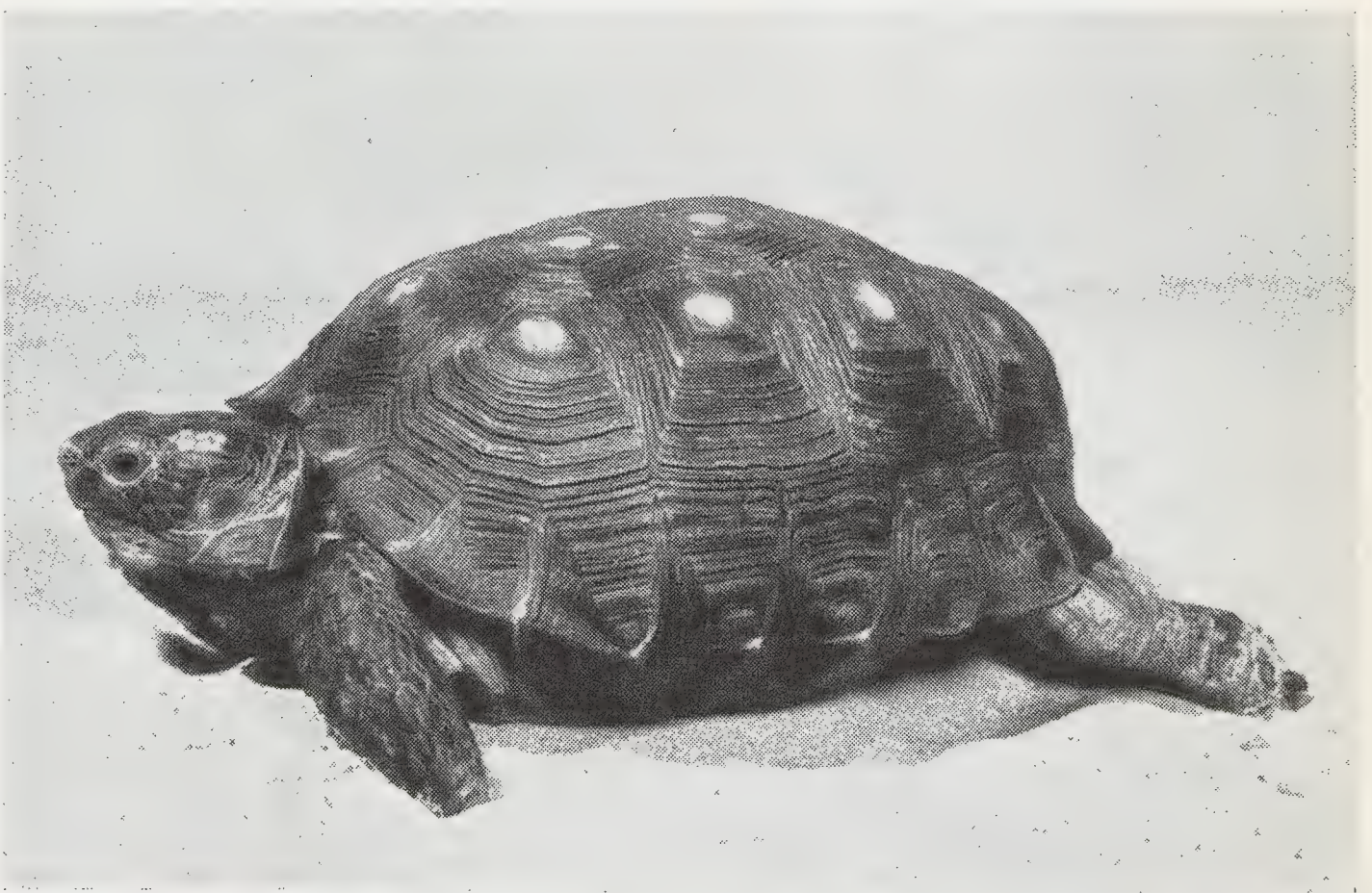
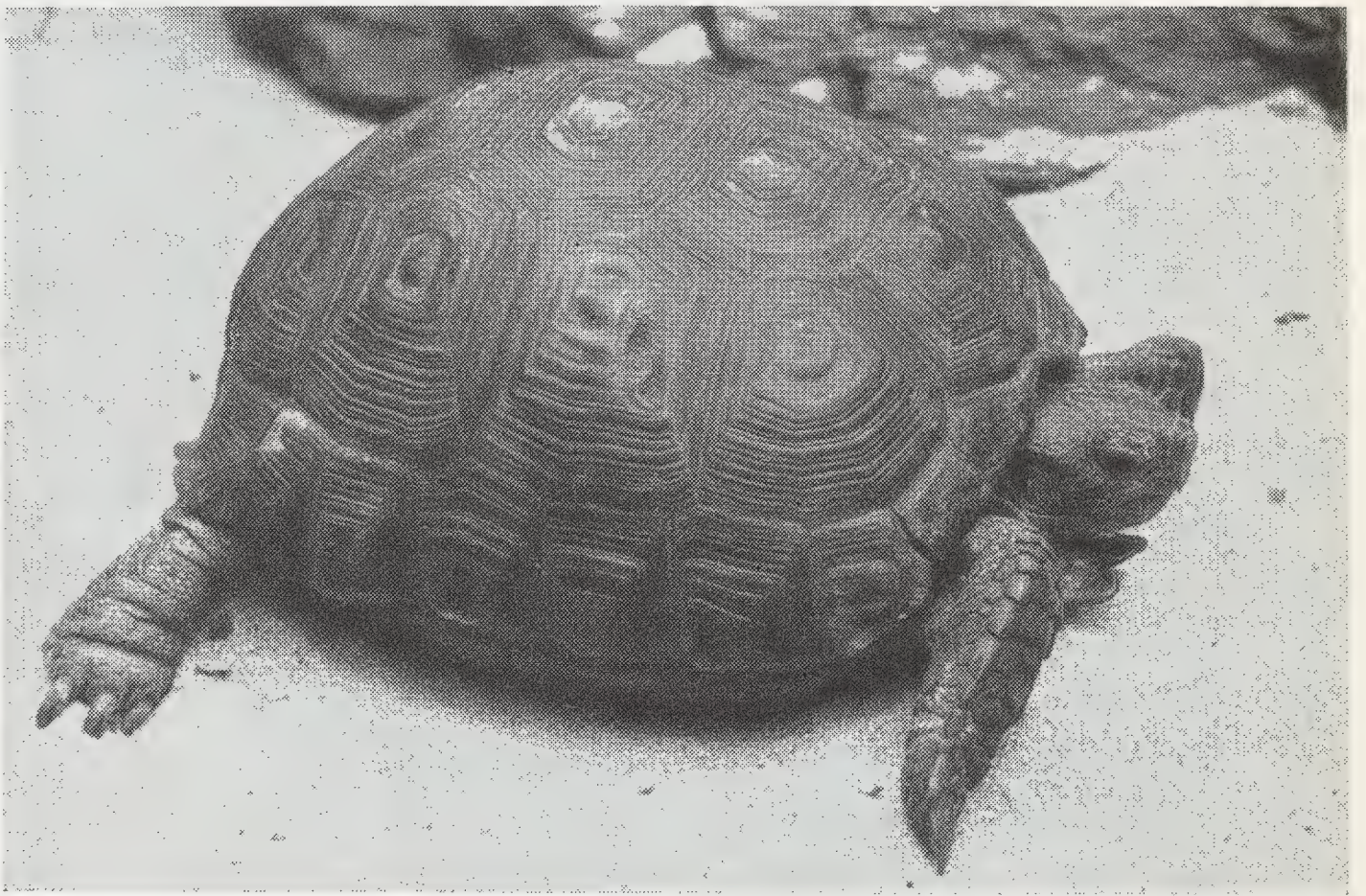
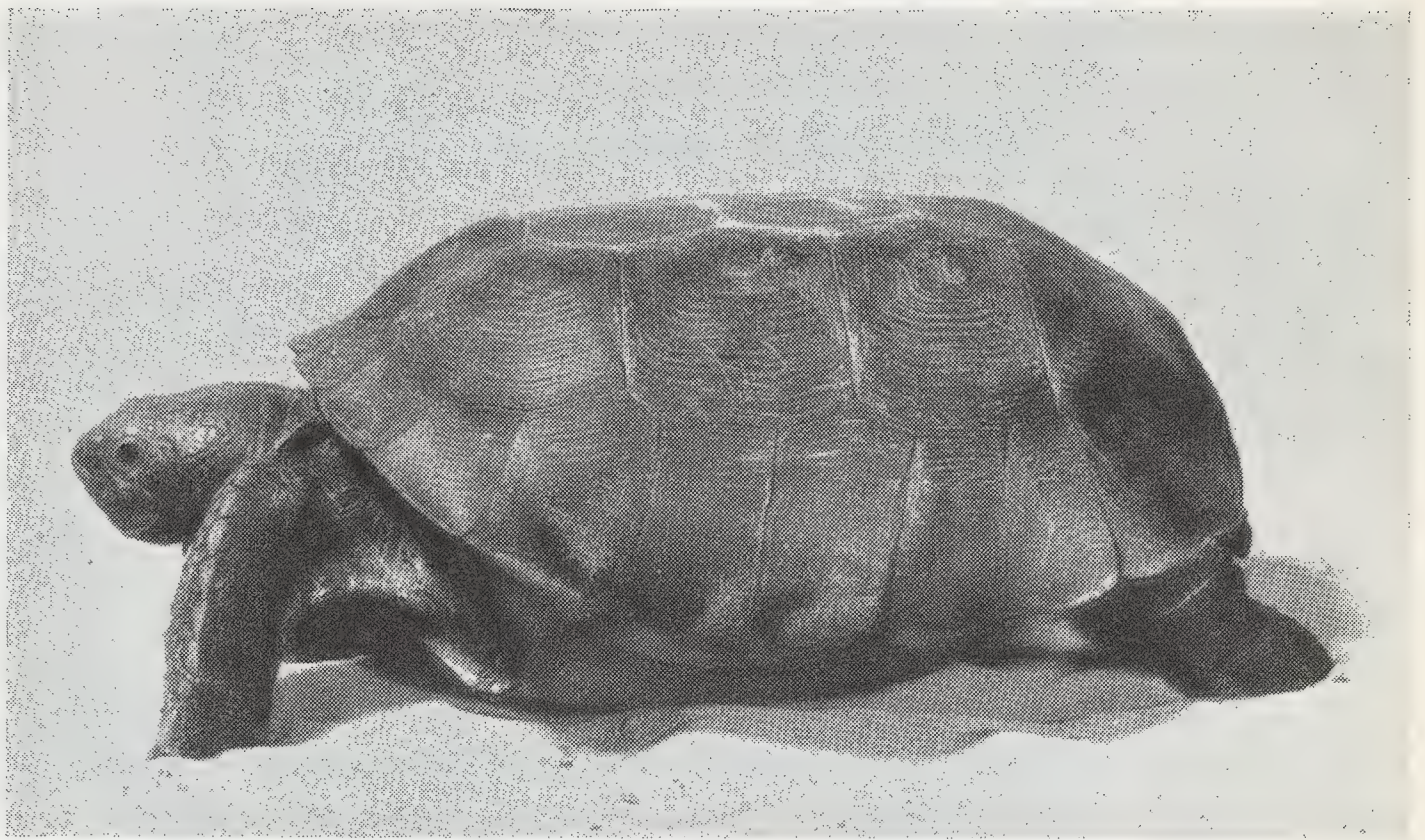
In times past any part-time biologist could point to a big tortoise and say, "Why, there is a *Testudo*!" This entertaining if not particularly informative ploy is no longer possible. The sprawling old genus *Testudo* that we once so readily applied to Galapagos tortoises and the like has been fragmented and the generic name *Testudo* now applies to only five species of smallish tortoises that live in the Mediterranean region. The most commonly seen of these are the Moorish and Hermann's Tortoises. These species have been kept as pets by Europeans for generations and recently they have appeared at local pet stores in considerable numbers. A pair of Moorish Tortoises kept by a Mr. C. F. Moysey in England have lived for more than 50 years and at last report (1956) were still in good health.

Perhaps the closest relatives of the Mediterranean tortoises are the Gopher Tortoises of the southern United States and northern Mexico. There are three separate populations that differ from one another mainly in shell and skull proportions, some being narrower, some broader. I am tempted to follow Mertens & Wermuth's check list on these and call them geographic races of a single species, although many workers consider them as distinct species. These tortoises do not appear to be nearly so hardy in captivity as are the Old World forms.

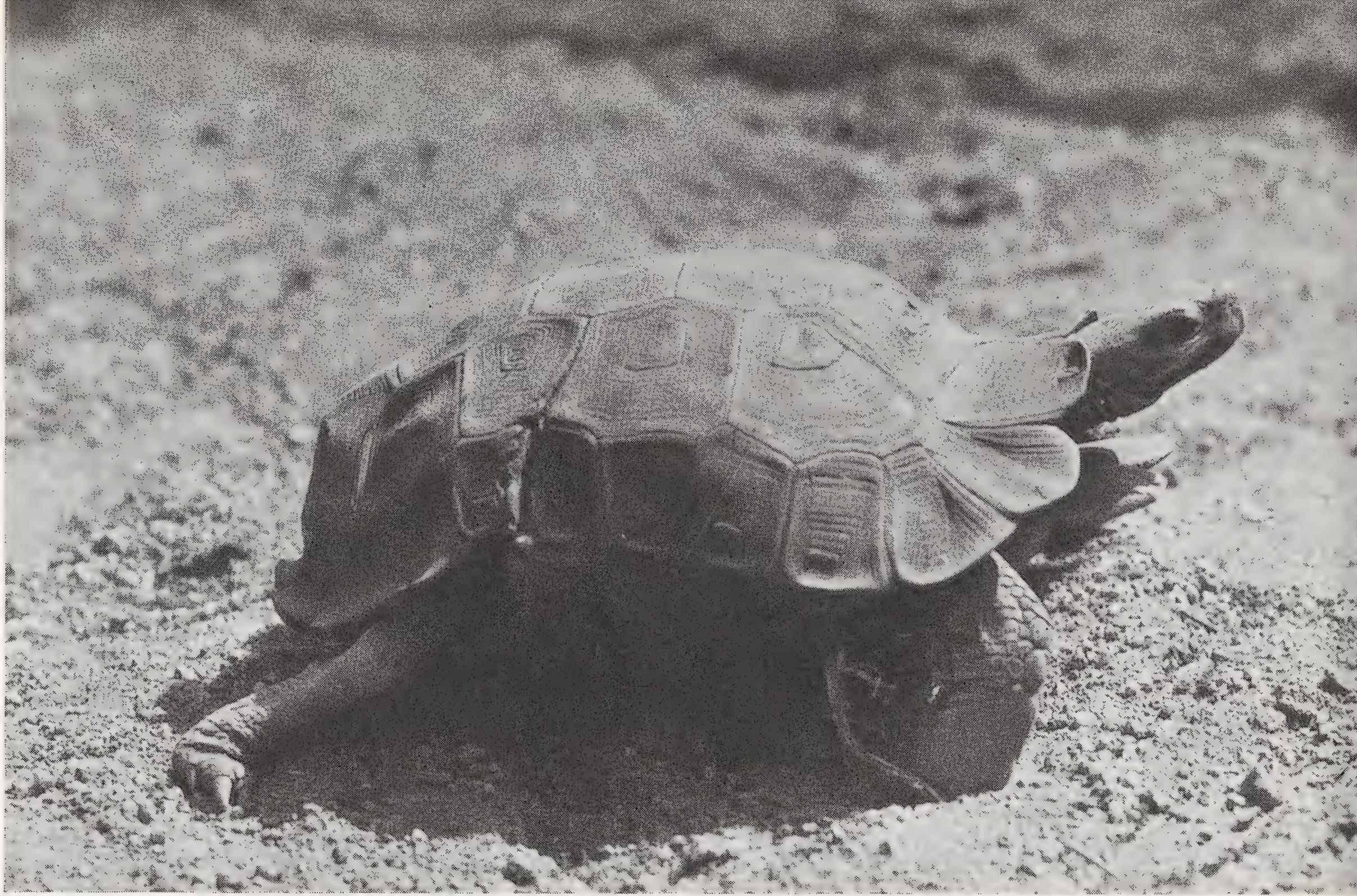
All of the other small tortoises are inhabitants of Africa and Madagascar. Some seven genera are now recognized among these, each genus containing only one to three species. Since they are relatively small animals, the Zoological Park has not made any considerable effort to obtain them. One of the more interesting kinds, however, the Hinged Tortoise, was exhibited long ago. It is unusual in that the carapace (upper shell) is hinged, rather than the plastron (lower shell) as in most turtles with hinged shells.

Another interesting species is the much flattened Pancake Tortoise, an inhabitant of arid rocky regions of East Africa. Having a flexible but horn-covered shell, it wedges itself into narrow crevices and then expands its body to resist being pulled out.

Representatives of two other small genera have



Gopher Tortoises (*Gopherus polyphemus*) of North America. Top — *G. p. polyphemus* is from the southeastern United States. Middle — *G. p. berlandieri* is found in southeastern Texas and northeastern Mexico. Bottom — *G. p. agassizii* is from southern California, Arizona, Sonora. All look much alike.



Top — From West Africa comes the Hinged Tortoise (*Kinixys erosa*), whose hinge can be seen across the posterior part of the shell. Left — The much-flattened Pancake Tortoise (*Malacocersus tornieri*) is an inhabitant of the arid and rocky regions of East Africa. It can wedge itself in a narrow crevice and then expand so as to resist being pulled out.

come to us recently by the purchase of a private collection of baby tortoises from Henry Gscheidle of New York. The Parrot-beaked Tortoise is of South African origin and little seems to be known of its habits in captivity. The Angulated Tortoise is also of South African origin and is somewhat better known. It appears to prosper under captive conditions and might, with its reddish plastron and alert disposition, become a favorite pet species.

Most of the tortoises that have been exhibited in the Zoological Park have been of the larger species that are now placed in the genus *Geoche-*

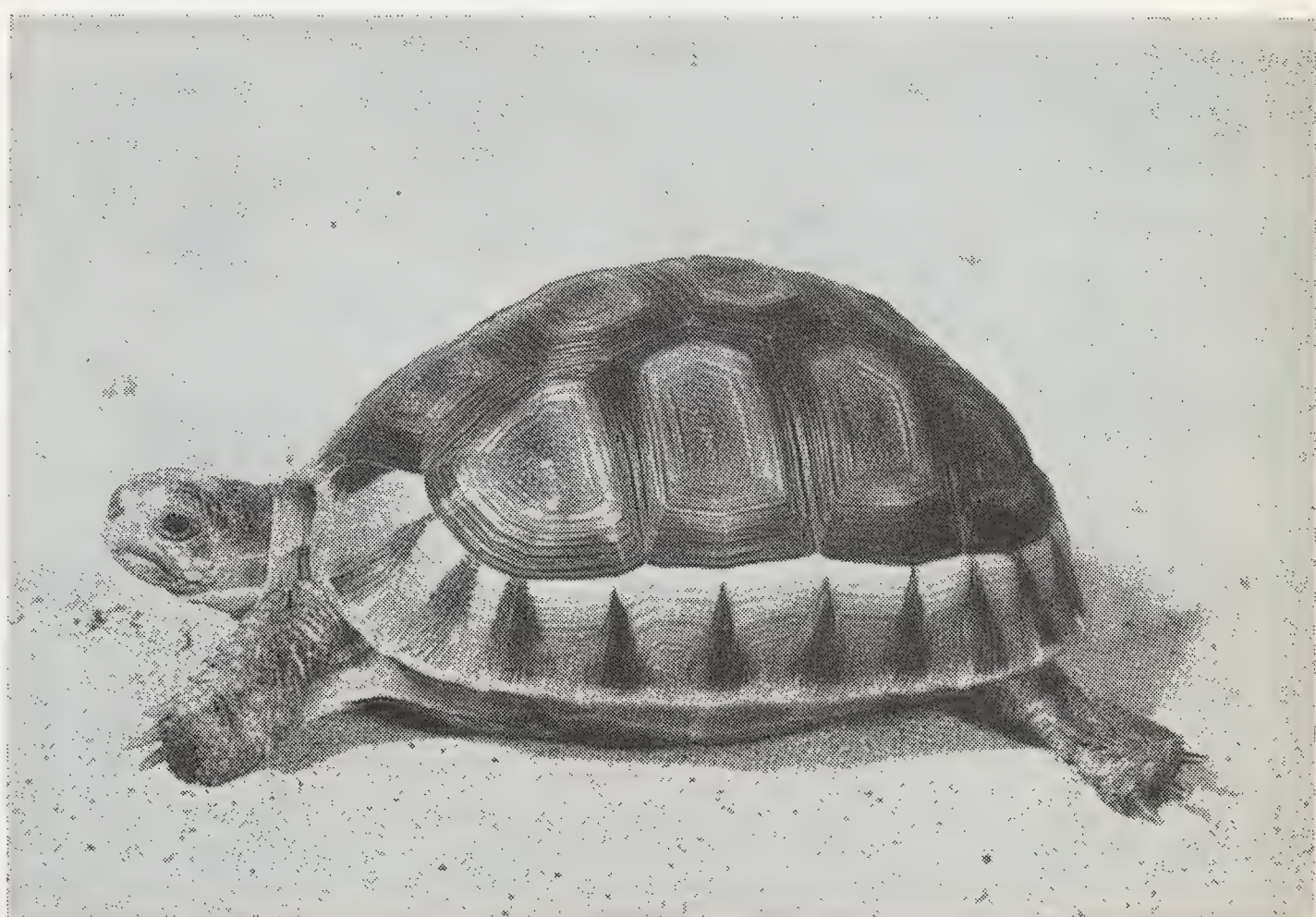
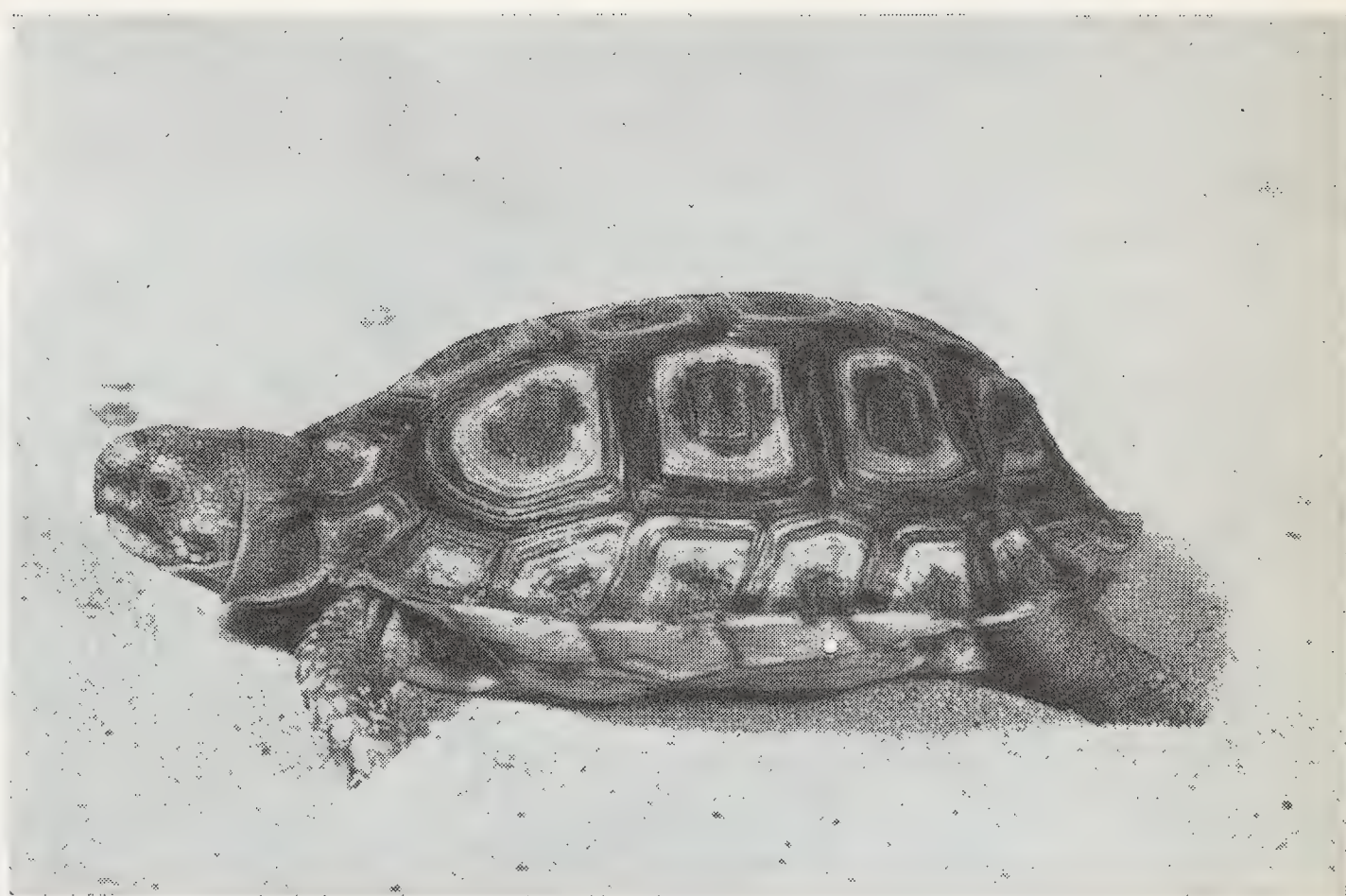
lone. Apparently, not only all of the giant tortoises of today but also the giants of past ages belonged to this group. The fossil record shows that in the past when the climate all over the world was little different from that of the deep tropics today, the giant tortoises were found throughout this continent as well as in northern Europe and Asia. The icy blasts of Pleistocene glaciers drove them toward the equator, however, and the cold winters of the temperate zones kept them from returning to their ancient stamping grounds. Meanwhile man, their greatest enemy, had become a common creature and has been the

major cause of their disappearance from their Pleistocene retreats.

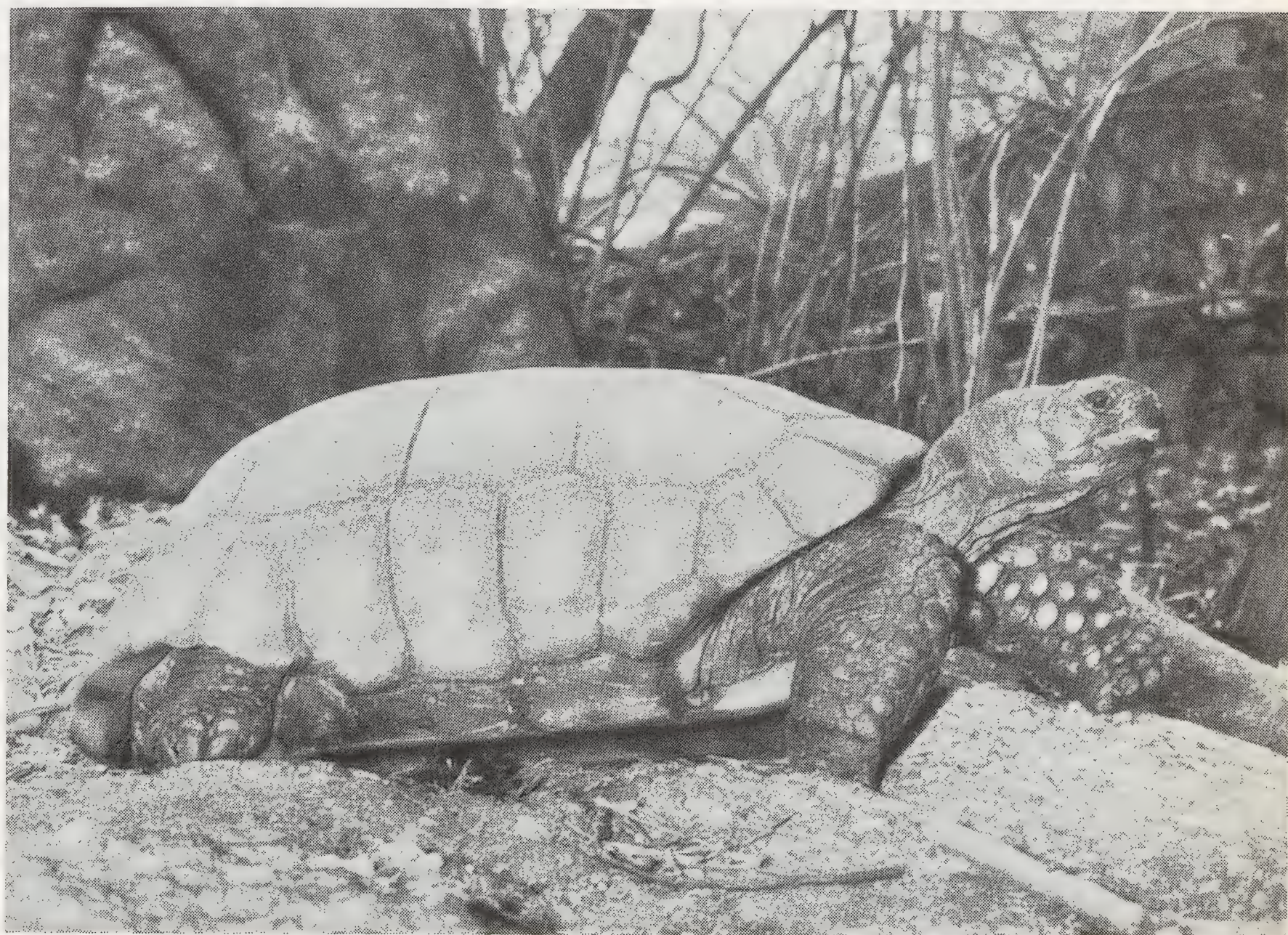
A comparison of the ranges of the smaller tortoises with those of their larger relatives shows clearly the differential effect of temperatures on these animals. The smaller tortoises, that can burrow and avoid the cold temperatures of winter, range broadly through the temperate zones (though, like most reptiles, mainly below the 40th parallel). The larger species, however, are too big to make extensive burrows and avoid freezing in this way. They are found almost exclusively within the tropics and the real giants are found within 10 degrees of the equator. Thus, though apparently scattered indiscriminately on small islands in different oceans, giant tortoises are really concentrated in a rather small region having the least variation in temperatures.

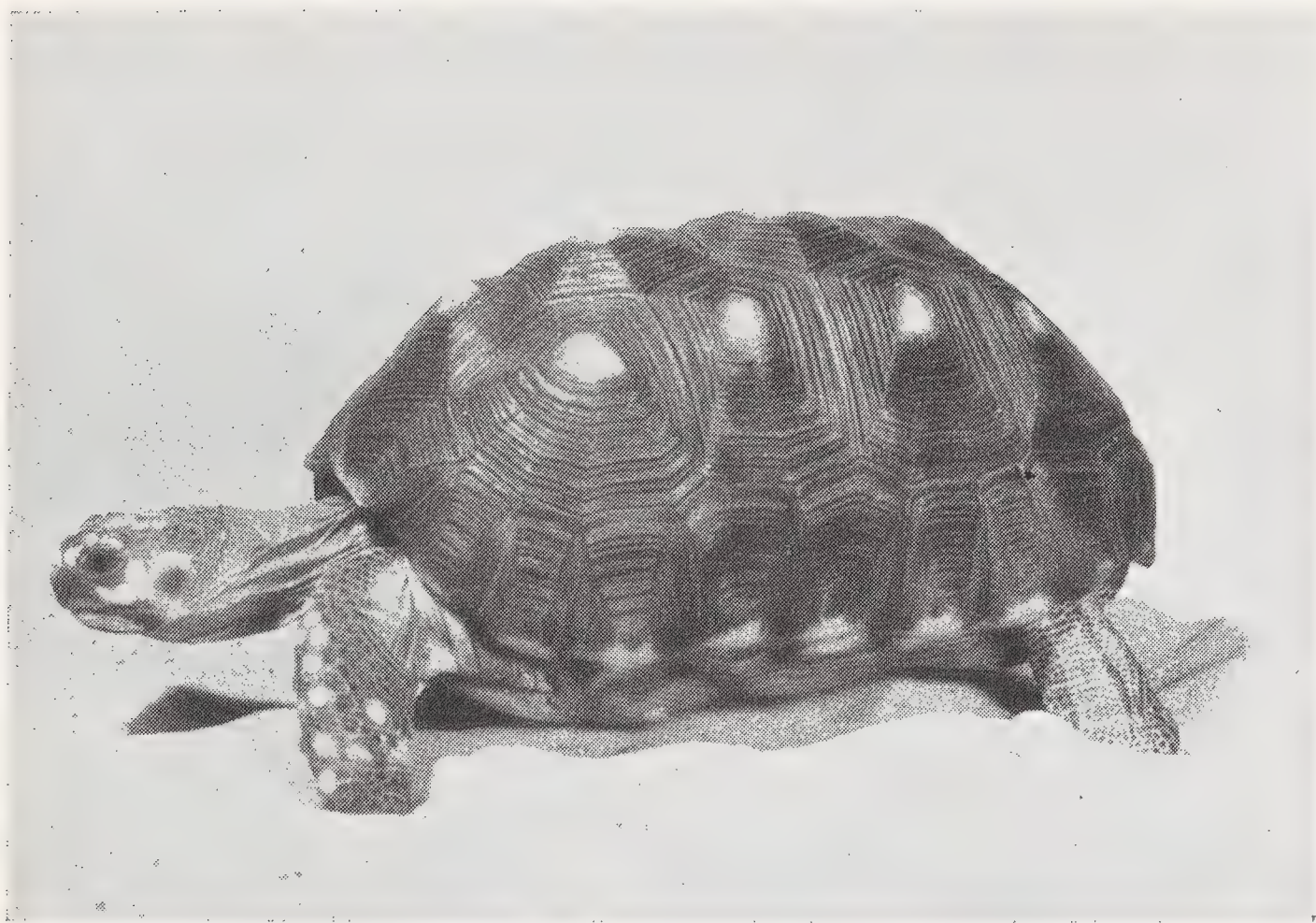
The oldest inhabitant of the Zoological Park is "Teddy," a South American Tortoise that was donated to us by Theodore Roosevelt on March 26, 1914. For many years it was thought that there was only one kind of "South American Tortoise" in northern South America, but last year Dr. Ernest Williams of Harvard pointed out that actually there are two. The other species is also in our collection. It is called the Red-footed Tortoise and does not attain nearly as great a size as the previously-recognized tortoise.

One of the most strikingly colored of the larger



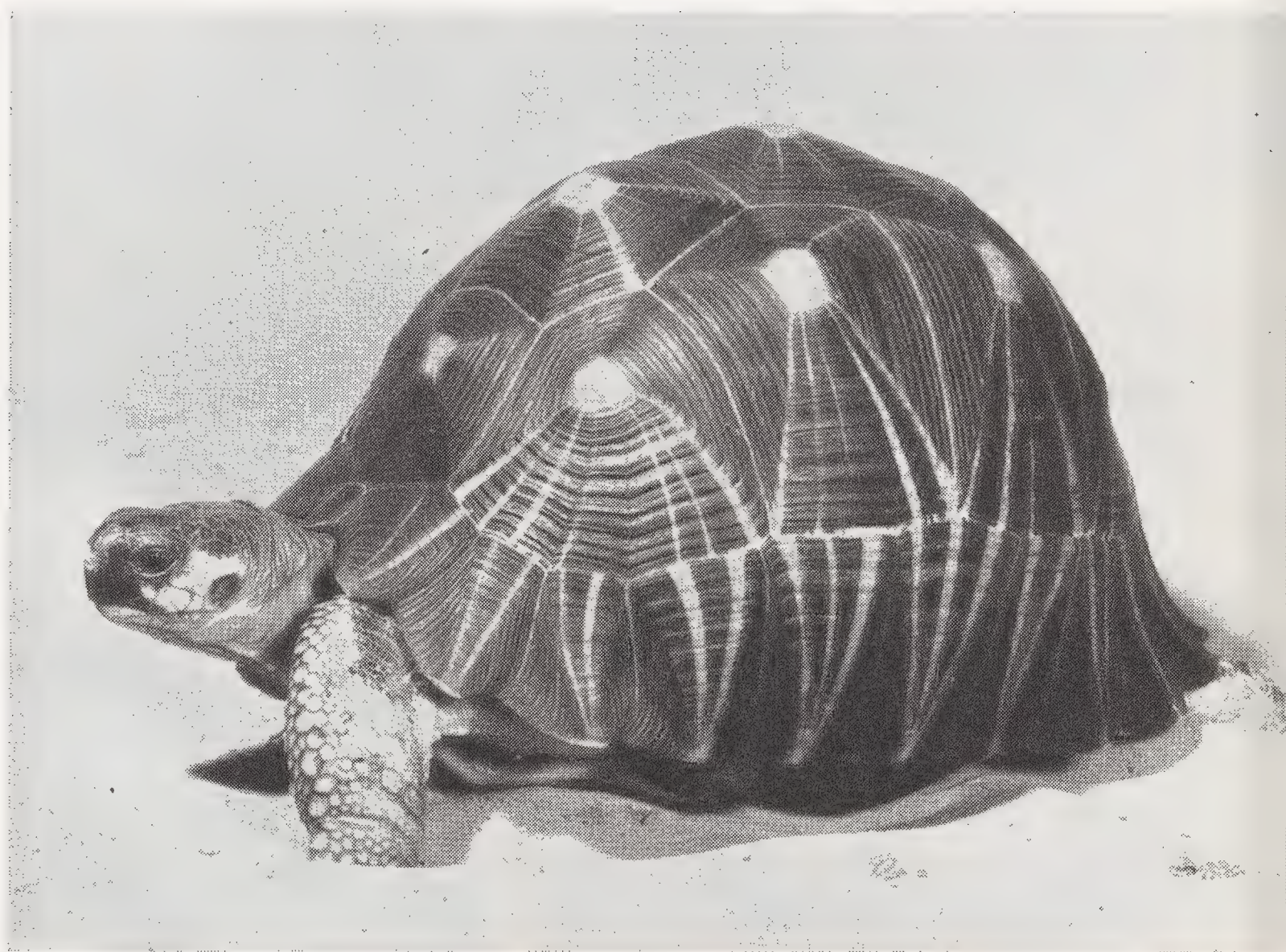
Top—The Parrot-beaked Tortoise (*Homopus areolatus*) comes from South Africa and little is known about its habits in captivity. Middle—The Angulated Tortoise (*Chersina angulata*), also from South Africa, is a vigorous and highly colored species. Bottom—“Teddy,” a South American Tortoise (*Geochelone denticulata*), is 22 inches long and weighs 46½ pounds. For many years it was believed that there was only one “South American Tortoise,” but two kinds are now recognized. We have the other species also, pictured on p. 72.





Left — The “other” species of South American Tortoise is the Red-footed Tortoise (*Geochelone carbonaria*) from the northern part of the continent. It does not attain nearly the size of the species represented by our oldest Zoo inhabitant, “Teddy.”

Right — Radiated Tortoise (*Geochelone radiata*) of Madagascar. This specimen, a female, weighs 22 pounds and has been in captivity for about thirty years.



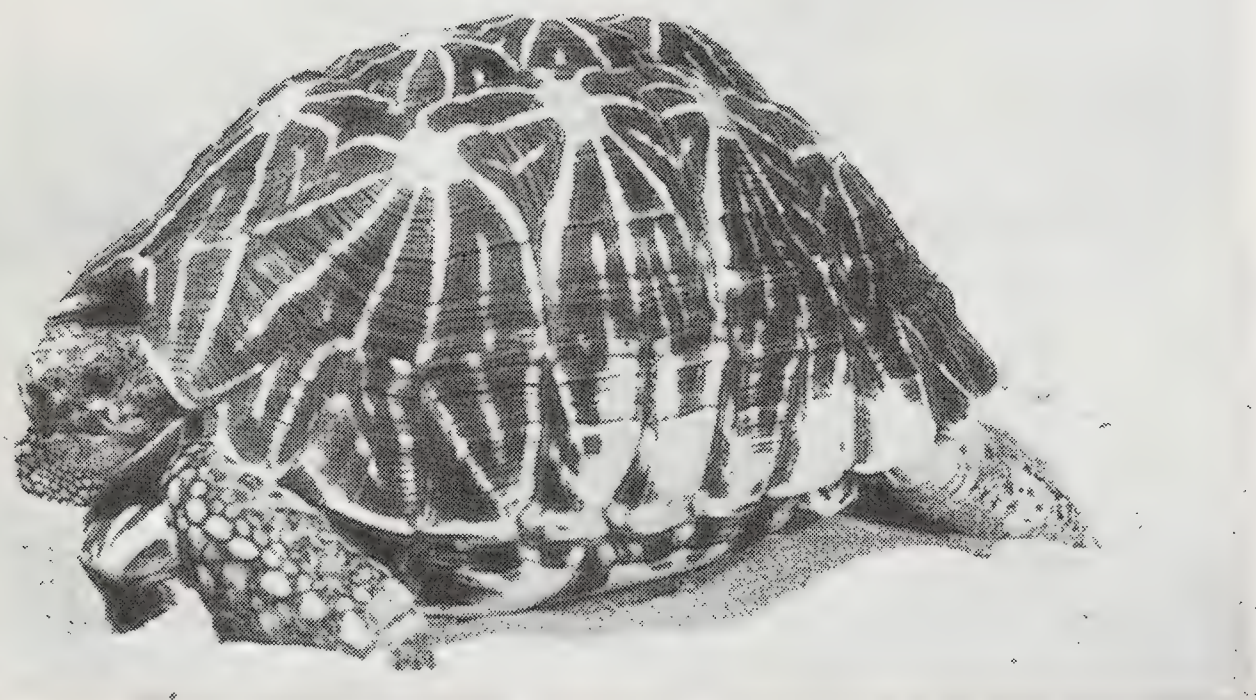
tortoises is the Radiated Tortoise. Last year we received one of these fine tortoises as a gift from Mrs. George Flowers of Brooklyn, who had kept it as a pet for more than 25 years. It is a female 14½ inches in length and now weighing 22 pounds — having grown somewhat too large for an apartment pet. We have since obtained two others to keep it company.

The Star Tortoise of India is similarly marked with black and yellow, but does not grow to the large size of the Radiated. It appears to live well in captivity and would seem to be an ideal choice as a pet.

Two African species, the Leopard Tortoise and the Spurred Tortoise, have adjacent ranges

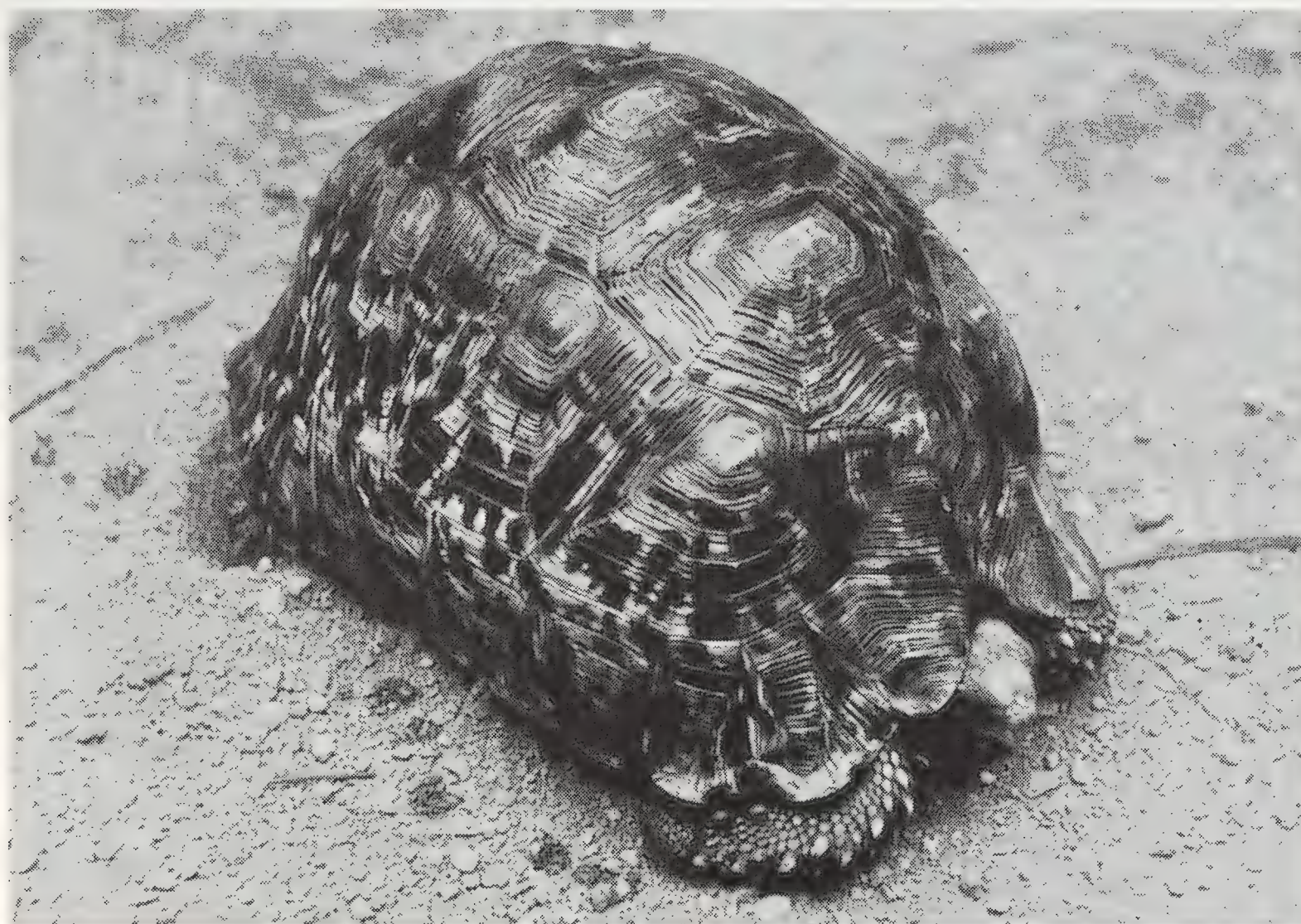
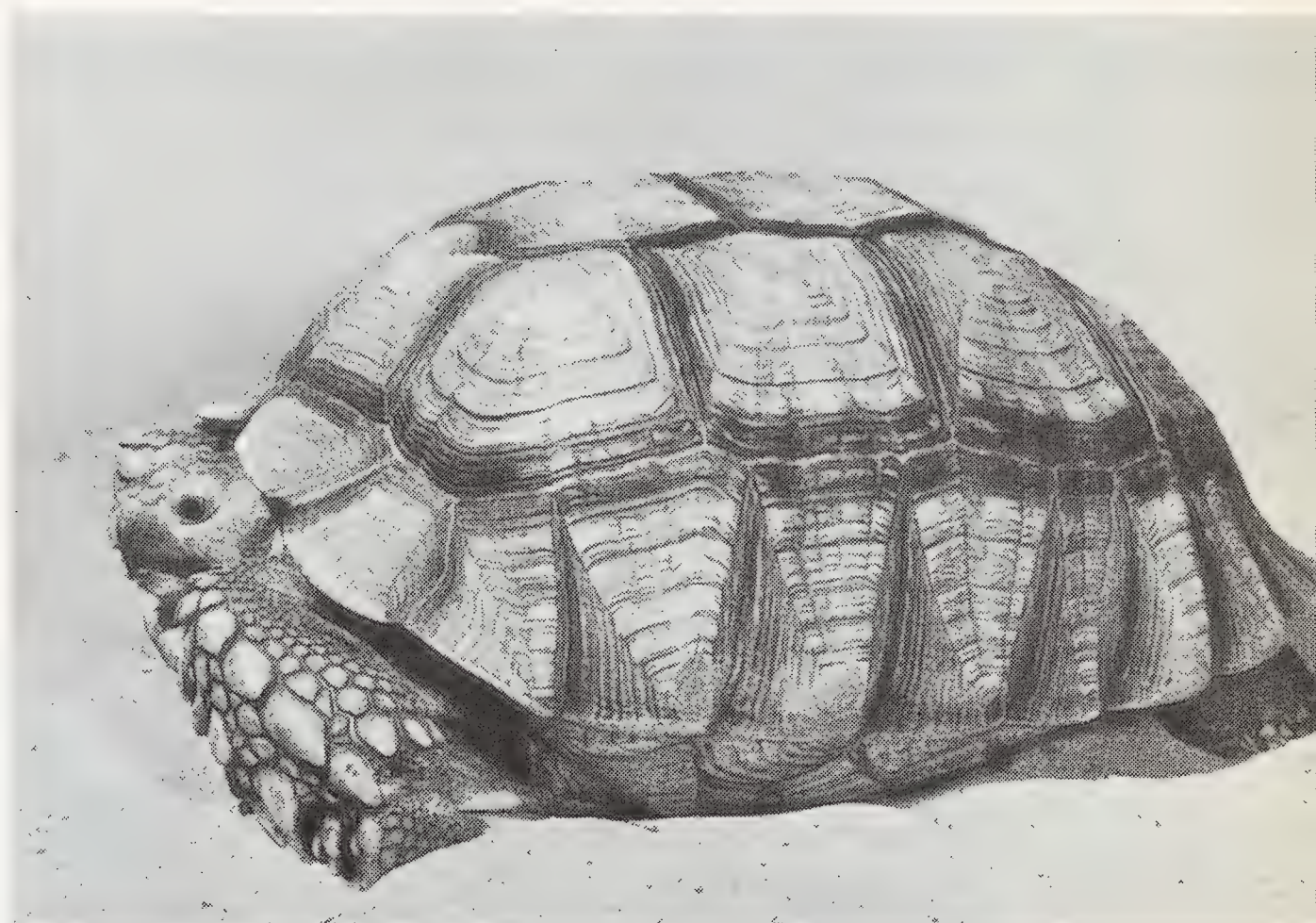
and differ mainly in color, and ultimately will probably be recognized as members of the same species. We exhibited the Leopard Tortoise many years ago and recently obtained an example of the less colorful, but rarer, Spurred Tortoise.

The giant tortoises that were once such a conspicuous feature of the reptile exhibit are no longer in the Zoological Park. This is not because the species are extinct (they are not, quite), but because after the renovation of the Reptile House in 1954 our winter quarters were not adequate for keeping them in good health and we sent the really big individuals “on loan” to Crandon Park Zoo in Miami. Four of the smaller tortoises were kept as examples of two of the



Left — Star Tortoise (*Geochelone elegans*) of India and Ceylon; this is a beautiful species that lives well in captivity and seems to be ideally suited to be kept as a pet. The maximum size it attains is about one foot.

Right — Northeastern Africa is the home of the Spurred Tortoise (*Geochelone sulcata*), a unicolor form not so often seen in captivity as its relative, the Leopard Tortoise.



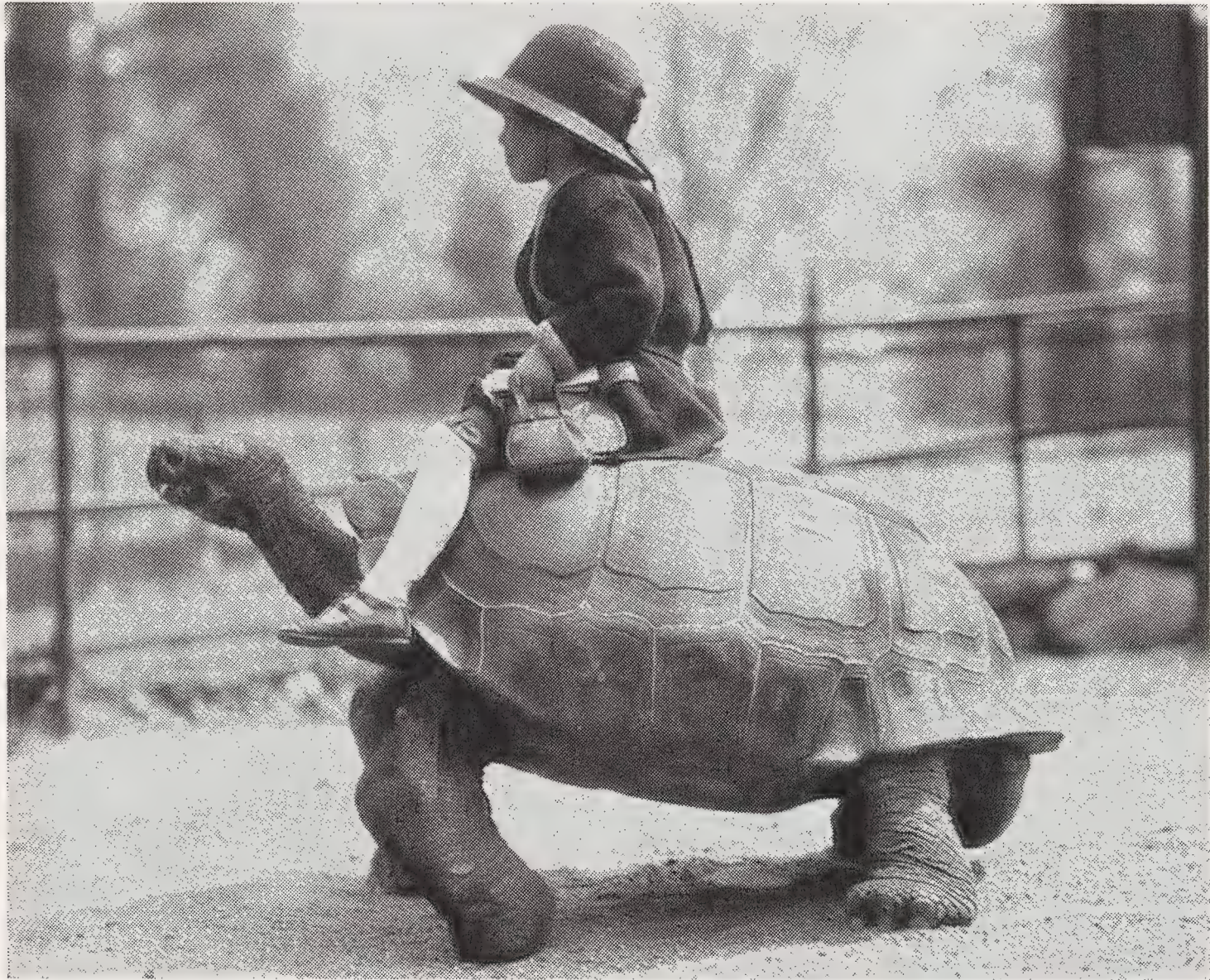
Left — Leopard Tortoise (*Geochelone pardalis*) of central Africa. It attains a length of two feet and may weigh 50 pounds or more. In time it will probably be recognized as of the same species as the Spurred Tortoise, occupying an adjacent range.

Galapagos forms. We have exhibited the Aldabra Tortoise, *Geochelone gigantea* (Schweigger), in the past, but have not attempted to do so in recent years because of the limited space available.

In the past as many as fifteen "species" of giant tortoises were recognized on the various is-

lands of the Galapagos, with at least one kind on each of the main islands. More recently they have been called geographic races of a single species, although they differ widely in proportions and shell-shape. First discovered in 1535 and throughout the 18th and 19th centuries collected as food for the crews of whaling ships,

ISLAND & TORTOISE INHABITANT	1800	1850	1900	1950
ABINGDON (= PINTA) <i>G. e. abingdonii</i> Günther	_____		-----	-----
ALBEMARLE (= ISABELLA) <i>G. e. elephantopus</i> Harlan				*
BARRINGTON (= SANTA FE) <i>G. e. ?</i>		-----	a	a
CHARLES (= FLOREANA) <i>G. e. galapagoensis</i> Baur	* ? -----	-----	a	a
CHATHAM (= SAN CRISTOBAL) <i>G. e. chathamensis</i> Van Denburgh	_____	* -----	-----	-----
DUNCAN (= PINZON) <i>G. e. ephippium</i> Günther		-----	-----	-----
HOOD (= ESPANOLA) <i>G. e. hoodensis</i> Van Denburgh	_____	-----	-----	-----
INDEFATIGABLE (= SANTA CRUZ) <i>G. e. nigrita</i> Dumeril + Bibron			*	-----
JAMES (= SANTIAGO) <i>G. e. darwini</i> Van Denburgh	_____	-----	-----	-----
JERVIS (= RABIDA) <i>G. e. wallacei</i> Rothschild			? -----	-----
NARBOROUGH (= FERNANDINA) <i>G. e. phantastica</i> Van Denburgh	_____		-----	-----



Top — A condensed history of the Galapagos Tortoises. (Solid line = numerous; dashed line = rare; a = reported absent or extinct; * = permanent residents (man) reported). Two questioned items are continued presence of tortoises on Charles Island after 1837, and the origin of tortoises on Jervis Island, thought by some to have been introduced there from Albemarle I. in 1891. Left — This Galapagos Tortoise (*Geochelone e. elephantopus*) is a specimen that came to us many years ago from Albemarle Island.

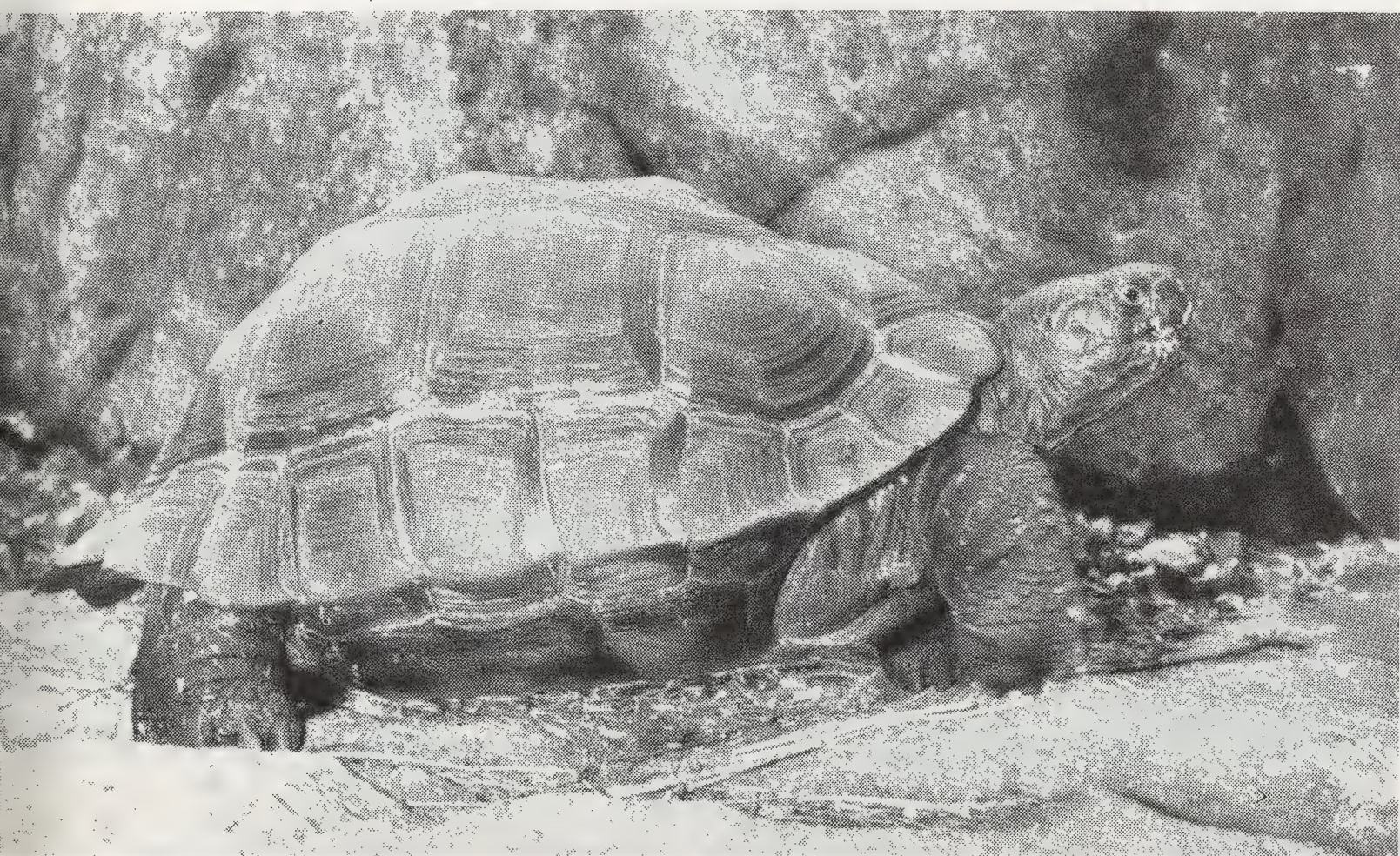
they are still eaten by the island inhabitants and rendered for oil by occasional parties from the mainland, although in theory they are protected from such depredations. As shown in the accompanying diagram, the tortoises of two of the islands are now extinct, are rare on most of the remaining islands, and were reported (in 1957) as common only on two.

Their future is far from secure even on Albemarle and Indefatigable. These islands have been colonized in the present century and the turtles must not only compete for food with feral asses, cattle and goats, but the young must also run the gauntlet of feral mice, rats, cats, dogs and pigs. It is said that probably “not one in ten thousand” young grows to adulthood.

The only hope of saving any of the Galapagos tortoises on their native islands (and the other native life as well) would appear to rest in the small laboratory built last year under the sponsorship of the Charles Darwin Foundation. The New York Zoological Society as well as UNESCO and other institutions have aided this project in a small way, but it undoubtedly will require much greater support to be effective. In a recent letter to William Conway, Mr. R. Leveque, the field naturalist of the laboratory, reported that the tortoises were so rare on Indefatigable that he had not seen a single wild individual in his entire six-months' stay to that date. And this on one of the two islands where they were reported as "numerous" in 1957!

Two of our present specimens are from Chatham Island and the other two from Duncan

Island. The Duncan Island individuals are from the Townsend Expedition that was sponsored by the Zoological Society in 1928. Many of the giant tortoises on exhibit in other zoological parks were obtained from this same source. The purpose of the expedition was to obtain a breeding stock so that they might not disappear from the face of the earth, should they become extinct in their native islands. More than a hundred small tortoises were collected. They have grown to adulthood now, but only the San Diego Zoological Park has had any success in getting them to breed. However, we are hopeful that we can obtain the winter quarters necessary for successfully maintaining them and that we, too, may carry on the work of conserving these unique animals — a work that was initiated by the Society in 1928.



Galapagos Tortoise (Geochelone elephantopus chathamensis) from Chatham Island. This one is from an expedition in 1957.

Saddleback Tortoise (Geochelone elephantopus ephippium) collected on Duncan Island by Charles H. Townsend in 1928. It is still living in the Bronx Zoo.



Fish Without Fathers

By JAMES W. ATZ

Associate Curator, New York Aquarium

THERE ARE MORE than 4,000 fishes in the Genetics Laboratory of the New York Aquarium. They are small ones and although some of them have attractive or unusual color patterns, none could be considered at all spectacular. It is not their appearance, but their usefulness in scientific research that makes them noteworthy and important.

About a tenth of the Laboratory's fishes form a group perhaps even more nondescript in appearance than the rest. A local fisherman might take them for some kind of killie — to which they *are* distantly related. A tropical fish fancier would undoubtedly recognize them as one of the mollies, but certainly not of any variety that he would choose to grace his home aquarium. The fancier would certainly be struck by one peculiarity: all of them, both young and old, are females. As for males — there aren't any! For the astonishing truth is that here is a species of fish in which more than 99% of the individuals are females which regularly give birth to broods consisting only of females like themselves.

The Amazon Molly, as it has been appropriately named, was first described in 1859, but its peculiar reproductive behavior was not discovered until 1932 when Prof. Carl L. Hubbs and his wife, Laura, began to breed the fish at the Museum of Zoology of the University of Michigan. Dr. Hubbs had been studying the different kinds of mollies and he knew that although he had in his Museum collection hundreds of preserved specimens of *Mollienesia formosa* (from *formosus*, Latin for graceful or beautiful), which had been caught in many places in northeastern Mexico and southern Texas, every one of them was a female. Soon Dr. and Mrs. Hubbs reported that

gravid females captured alive and brought into the laboratory gave birth to broods consisting entirely of daughters. At first this looked as if it might be a case of parthenogenesis, or virgin birth, but any *M. formosa* kept isolated from male fish never produced any young. When virgin *M. formosa* were mated with male mollies of other species, however, the offspring were all females that looked exactly like their mother! In nature, *M. formosa* lives side by side with other mollies, *M. sphenops* and *M. latipinna*. It was logical to conclude that the all-female species "used" the males of the others to propagate the race, the offspring never being hybrids but pure *formosa* just like their mothers.

For twelve years Dr. and Mrs. Hubbs carried on their breeding experiments with the Amazon Molly. In all, they bred about 8,000 of them, all female and all carbon-copies of the fish that bore them. The Michigan investigators found that the Amazon's mate did not have to be a molly, but that when another type was used the number of offspring was decidedly less than when a species of molly acted as pseudo-father. At least ten different, but more-or-less closely related, species have been mated with Amazon Mollies and have produced not hybrids, but more Amazons. Evidently it is necessary that the Amazon Molly — or what is much more likely, its eggs — be stimulated by some physiologically compatible male before development can occur. The exact process is uncertain, but most probably the sperm "triggers" development of the egg but contributes nothing to the heredity of the new generation — and so "father" is really not the father. Biologists have found similar "fatherlessness" in a beetle and a few worms and have pro-



Top — A view of the Genetics Laboratory of the Aquarium, housed in the American Museum of Natural History. Dr. Klaus D. Kallman, Research Associate in Genetics, is here continuing the work of the late Dr. Myron Gordon, among the laboratory's 655 tanks. Right — Preparing a Platy for transplant.

duced it experimentally under laboratory conditions in some frogs, newts and invertebrates. (They call the phenomenon *gynogenesis* or *pseudogamy*). When Amazon Mollies were microscopically examined, in an effort to find out exactly what was happening to their eggs, no direct evidence could be found, but this might have been because the cells of fishes are notoriously difficult to study under the microscope — much



more so than those of frogs, insects and many other invertebrates.

At any rate, there were still many provocative, unanswered questions about how the Amazon Molly propagated itself and what was the exact genetic relationship between mother and daughter. In fact, the situation was so startlingly different from anything known to occur naturally in a backboned animal that some biologists expressed doubt about its very existence.

What was needed was some new way to analyze the problem, and Klaus D. Kallman of the Aquarium's Genetics Laboratory had developed a new technique exactly suited to this need. He had developed this new research tool for another purpose, but as is so often the case in science, it proved to be perfectly adapted for another, unanticipated task.

In 1953, Kallman was a new graduate student at New York University with a keen interest in the genetics and physiology of fishes. Naturally he sought advice from Dr. Myron Gordon, who was a member of the faculty as well as the Aquarium's Geneticist. It was arranged that Kallman would do his research work in our Genetics Laboratory. When the time came to select a thesis subject, Dr. Gordon made a suggestion that was to open up a whole new field of investigation in the laboratory. Why not, he asked, try to transplant fins between members of the inbred strain of Common Platyfish in the Laboratory?

Behind this deceptively simple suggestion lay a good deal of up-to-date biological theory, in addition to 15 years or more of painstaking, single-purposed effort of Dr. Gordon himself. Transplantation is not a new experimental procedure in biology; some of the pioneer experiments with endocrine glands and embryos involved the transplantation of organs or tissues from one animal to another. In medicine, too, skin grafting became an approved treatment for extensive burns, and bone grafts for use in orthopedic surgery. In all of these procedures, however, successful permanent transplants or grafts could be obtained only if they were made from one part of a single individual's body to another, or between identical twins, or members of the same closely inbred strain. (Embryos are often exceptions in that they do not react adversely to strange tissues). Otherwise, although the trans-

planted, foreign tissue or organ might at first look healthy, eventually it would break down, disintegrate completely and disappear. The basis for this incompatibility was eventually shown to be hereditary, and in some cases could be traced to the activity of definite genes. The ability of the body to produce specific substances that destroy the foreign tissue that has "invaded" it is related to its ability to overcome disease-producing microorganisms, but whereas doctors try to enhance the latter ability, there are times when they wish the body would not react to tissues belonging to other more-or-less unrelated individuals. If this defense mechanism could be circumvented, doctors foresee lifesaving "banks" of hearts, kidneys and other vital organs, just as blood banks are now a regular part of the medical scene.

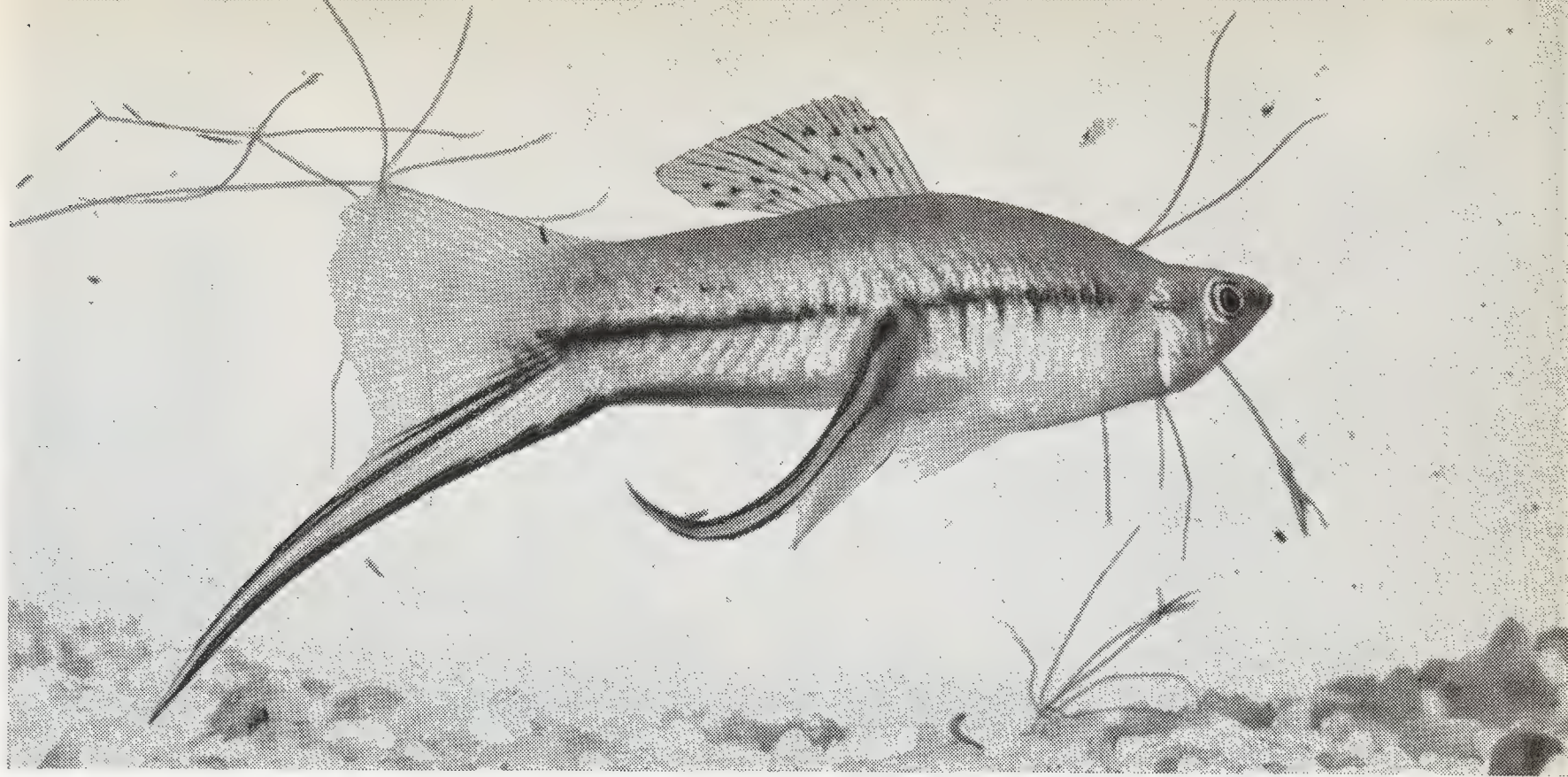
Fish scarcely differ from man or mouse in this regard. Up to the time Kallman started his experiments, no one had ever succeeded in transplanting fins, or any other structure for that matter, from one fish to another. Dr. E. E. Held of the University of California showed that the dorsal fin of a Common Platyfish could be moved to its belly region, but that fins from another Platyfish survived for less than a month. Held's work had led Dr. Gordon to suggest that the strain of Platyfish he had been so carefully inbreeding for the past 15 years be used in a similar experiment. Dr. Gordon predicted that these fish, which had been systematically bred brother-to-sister for nearly 20 successive generations, would accept fins from each other as if they were their own, because he believed they were genetically as alike as identical twins. His prediction was abundantly fulfilled. As soon as Kallman had mastered the mechanical details, he was able to transplant fins with 100% success.

Since the summer of 1954 when he made his first successful fin transplants, Kallman has made thousands more of them. In the course of one series of experiments, he made almost 3,000 transplants involving about 4,000 fish. This work comprised his doctoral thesis and dealt with how genes function in affecting survival of transplanted tissues. In another series of experiments, Kallman determined that at least 12 genes were concerned in the reaction of the Platyfish host to a foreign fin.

Having developed an infallible transplantation

The laboratory maintains inbred Swordtails as well as Platyfish and this is a Swordtail which developed an extra sword after an early transplant of a tailfin.

Klaus D. Kallman Photo



technique, Dr. Kallman could now use it to determine the genetic relationships between fishes. In other words, if fin transplants between two fishes were successful, it would be safe to assume that they were genetically identical, or very, very nearly so. This is exactly what biologists wanted to know about the Amazon Molly and her offspring! Are they genetically alike? And if each daughter is really a genetic carbon-copy of her mother, she and all her sisters must be in effect the same as identical twins. Transplantation tests on Amazons donated by Dr. Caryl Haskins, and their offspring, showed that in any Amazon family all the members are indeed alike, since fin transplants among them "took" without exception, while those involving fish from different families did not. Each fatherless group could be considered a *clone*, which is the biologists' term for the animals or plants descended from a *single* parent.

The next step was to obtain wild Amazon Mollienesias for testing, which Kallman caught near Brownsville, Texas. Fin transplants showed these fish to be even more homogeneous than expected. All of them proved to be members of but three clones. The implications of this for evolutionary theory are too complicated to outline here; suffice it to say that they have given Kallman plenty of food for thought. One of his current projects is to obtain more samples of wild Amazons for testing. His transplantation test gives him the rare opportunity to describe the population structure of the species in nature, which should in turn provide definite clues as to how its unorthodox method of reproduction evolved.

Mention ought to be made of the fact that once in a great while, a male *Mollienesia formosa* turns up. If and when Dr. Kallman gets a chance to test one of these and its offspring — supposing that it does actually contribute to the heredity of

the young — a better understanding of the significance of such masculine rarities will be forthcoming.

Last year Dr. Kallman's fin transplantation test enabled him and Dr. John Kilby of the University of Florida to prove that true parthenogenesis can occur in fish. Dr. Kilby was conducting extensive breeding experiments with Mosquito Fish (*Gambusia affinis*), and two females that he was sure were virgins had thrown a few young. In such cases, there is always the nagging possibility that somehow a male got in and out of the female's aquarium unseen. To clinch the matter, Kallman made a trip to Gainesville and transplanted fins from the young fish to their mother. They "took," thus demonstrating that no male had contributed to the heredity of the offspring to make it different from that of the mother. Dr. Kilby's case for parthenogenesis is air-tight now.

Fins are not the only structure that Dr. Kallman has been able to transplant from fish to fish. Skin, scales, pigment cells, heart, spleen, kidney, gonad and pituitary gland have all been removed from one fish and made to flourish in another. Thyroid tumors and pigmented cancers (melanomas) have been transplanted from sick to healthy fish. The possibilities for new experiments seem endless. For example, Dr. Kallman is inbreeding a strain of hybrid origin that regularly develops a melanoma on its dorsal fin, which is an ideally accessible location for observation and transplantation. With these and other special strains — some already in existence in the Laboratory, others to be made-to-order — Dr. Kallman is planning critical experiments on the origin, migration and development of normal and cancerous pigment cells. The Genetics Laboratory stands on the threshold of exciting and fruitful times.

Zoo News in Pictures

Photographs by SAM DUNTON



There is a lot of "Springtime in the Zoo" atmosphere in this scene on the **ROOSEVELT ELK** range in the center of the Zoological Park — a wild and undisturbed scene that we often find visitors gazing at for many minutes at a time. The Elk herd is still small; it includes three cows, a buck and a yearling cow. But in the normal course of things we can expect annual additions — one, at least, is likely this year — and we hope to build the herd up to sizeable proportions. (A fawn was born May 30).



The **INDIAN PANGOLIN**, *Manis crassicaudata*, had not been represented in our collection until an adult female and two young arrived this spring. Pangolins usually have one young, rarely two, and we are not certain whether the babies both belong to the female. Only one is still nursing, in any event. They appear to be doing well on our anteater diet.

It is doubtful that anyone has ever before exhibited the **LAMINATED-BILLED TOUCAN** from Colombia and Ecuador; we received our first one a few weeks ago. The peculiar name comes from the plate at the base of the brightly colored bill. It is being exhibited in the Toucan hall of the main Bird House.



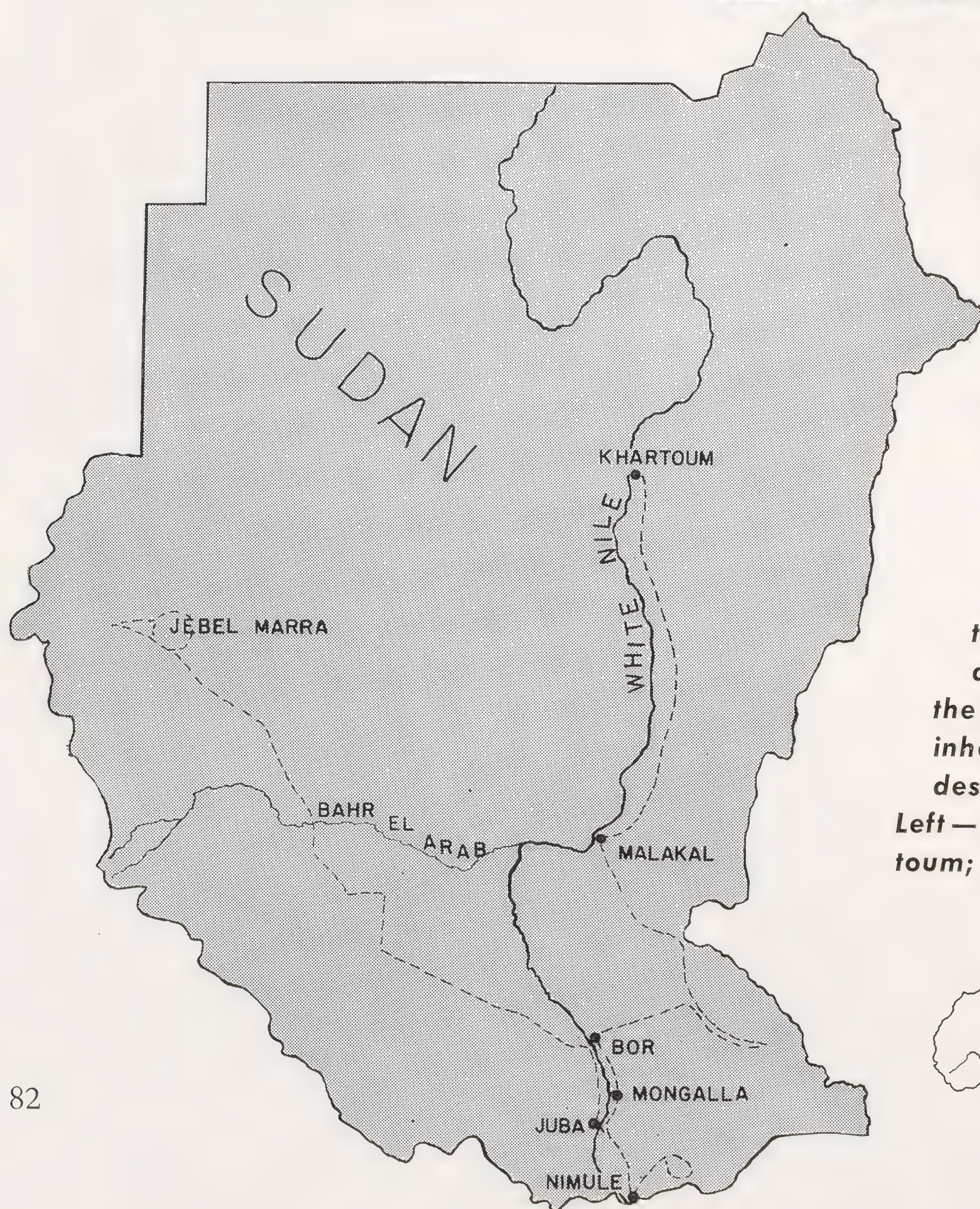
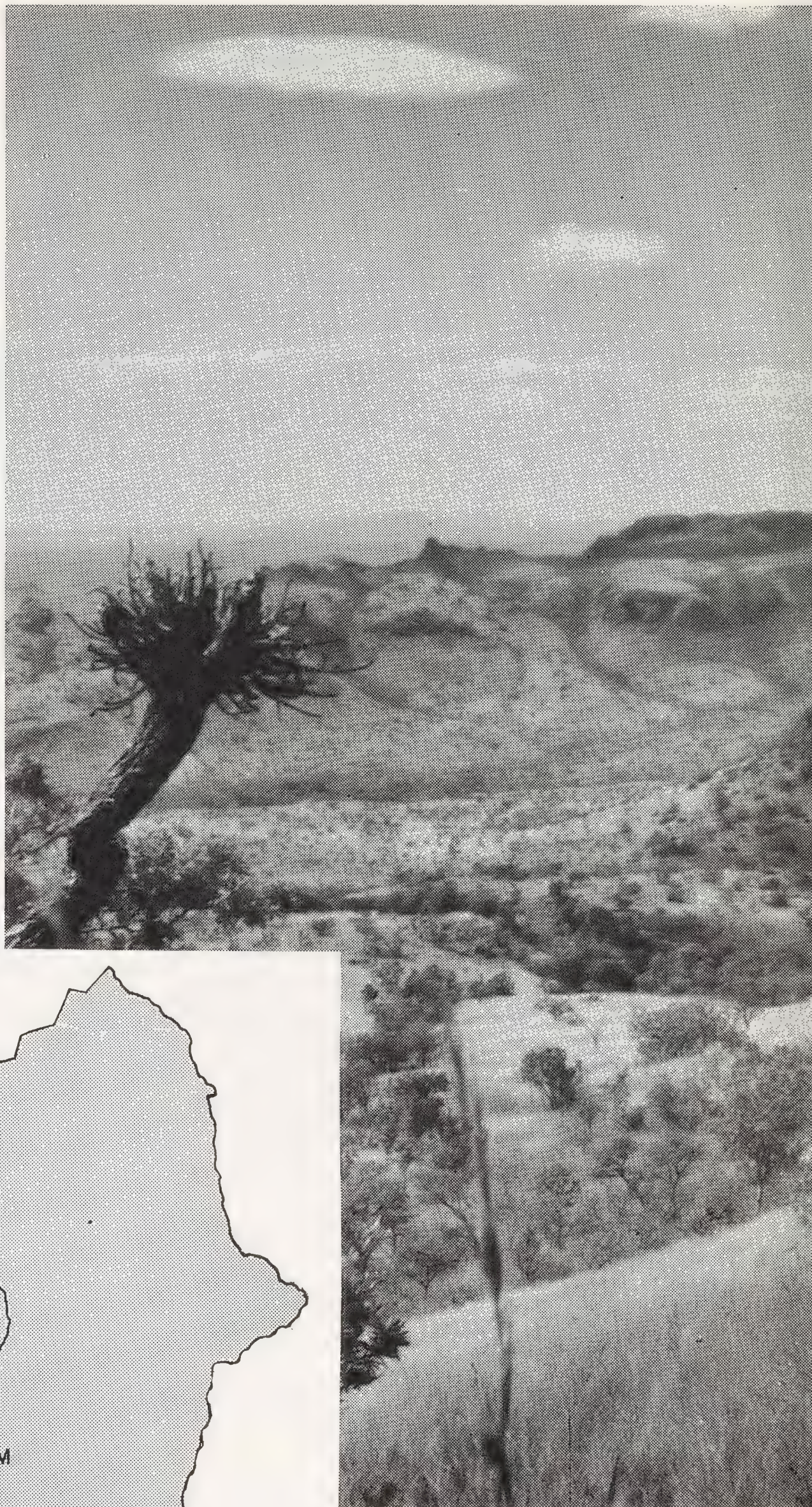
Dogs are not allowed in the Zoological Park — but **DINGOS** are. These are two Dingo pups, born on January 1 in a litter of seven. These two will be kept for breeding stock, and since they have been virtually hand-reared Keeper Foster allows them the run of the Kangaroo House before opening time every day.

New York Times: Brower Photo



A Look at Wildlife in the Sudan

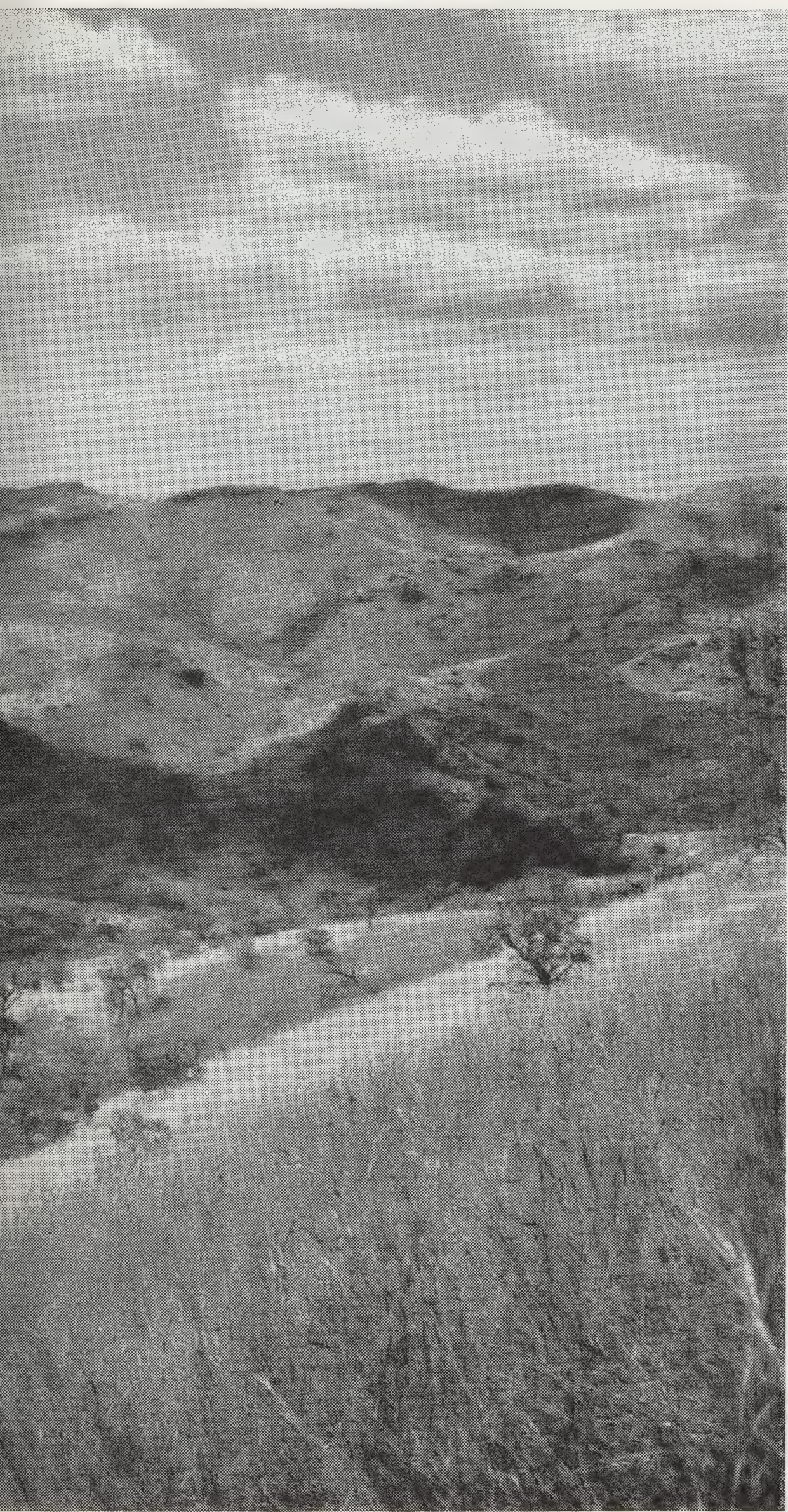
By GEORGE W. MERCK
Secretary of the Zoological Society



Above — The Boma Hills in the southeastern Sudan are close to the Abyssinian border. Zebras and antelopes and giraffes roam the surrounding plains and buffalo inhabit valleys and hills. Fire has destroyed much of the forest cover. Left — The expedition started at Khartoum; dotted line indicates its route.

Photos by the Author





FOR MORE THAN SIX WEEKS, beginning at the end of January, Dr. F. Fraser Darling, Vice-president for Research of the Conservation Foundation, and I travelled in the Republic of the Sudan. We were there as guests of the Sudanese Government, to assess the wildlife with regard to population and condition of habitat, and particularly to recommend measures for conserving this important national asset for the future. The available time, of course, was much too short to make a detailed and complete study such as Dr. Darling has made in two other important game areas of Africa — the Luangwa Val-

ley in Northern Rhodesia and the Mara Plains of western Kenya. Nevertheless, we were able to see a considerable amount of country and some of the species of larger mammals, and to obtain what we hope are enough data to recommend an effective policy for the proper conservation of game.

The Sudan is an immense country. It stretches over 18 degrees of latitude south from the Egyptian border, a distance equal to that between Toronto and Palm Beach. From east to west, the country is a thousand miles across at the widest point, and it covers almost a million square miles. This is two-fifths the area of the United States.

Beginning at the north, the Sudan separates roughly into five principal divisions of vegetation: desert, acacia desert scrub, acacia short-grass scrub, acacia tall-grass forest and broad-leaved woodland and forest. Rainfall varies from complete drought in the desert north to sixty inches in the extreme south and, as might be expected, is responsible for the gradation of the vegetation. Immense flat expanses of bush, woodland or marsh, broken occasionally by rolling hills, compose the principal scenery. In the south, mountain groups rise to 10,000 feet, and in the west the mountains of the Jebel Marra tower to the same height above the monotonous rolling plain. But the dominant feature is the White Nile which cleaves the country in two, and with its powerful tributary, the Blue Nile, pouring out of the Ethiopian highlands, influences all life for more than 1,500 miles from the border of Uganda to Wadi Halfa.

In its upper reaches within the boundaries of the Sudan, the Nile broadens into a huge swamp choked with thick mats of papyrus. This is the famous Sudd, which in Arabic means "barrier." Today, channels are kept open and steamers run regularly, but for centuries this papyrus curtain kept the secret of the source of the Nile from all who tried to approach from the north.

During the annual rains the river creeps up from the permanent swamps and inundates an area the size of England. When the water retreats again in the dry season, this land becomes meadows of almost pure grass, which is known as the "toich." The calm sea of green is broken only by an occasional island of palms or acacia

on higher ground and shifting channels and lakes edged with the plumes of papyrus and "vossia," a reed known to the Arabs as "um suf" — mother of wool.

Our first area of study was in the "toich." At the old trading post town of Malakal we boarded a very Victorian sort of houseboat with a screened verandah on the upper deck and were propelled upstream by a woodburning paddle-wheel steamer alongside. As we passed the main landing of Malakal a hippopotamus surfaced, looked around, and sank in a swirl of bubbles. This hippo and a handful of his relatives were the only mammals we saw until we landed some thirty miles up-river the following morning. The variety and number of birds were astonishing. Herons and egrets lined the edge of the river, stalking fish and frogs in the shallows. Around the grassy points, flocks of Whistling Teal dabbled and sprang into the air at our approach. Other waterfowl were plentiful, as were the harrier hawks endlessly patrolling the water meadows behind both banks. Brilliant carmine and green bee-eaters zigzagged across the channel and far overhead vultures and kites circled in a cloudless sky.

We were impressed most by the shorebirds. These migrants from the Arctic coasts of Europe winter in their thousands along the Nile. Clouds of Ruffs and Ringed Plovers continually rose and settled again as we went by.

The next morning we waded ashore through shallow lagoons to dry land. We were on a large island which is a reserve for Mrs. Grey's Waterbuck, the Nile Lechwe. The area holds several thousand and they are apparently undisturbed by the Nilotic tribesmen who graze their cattle and burn off the long grass in the reserve. This water-loving antelope moves in large herds. The mature buck is a striking blackish-brown with a white saddle on the shoulder, and long lyre-shaped horns. From the top of a termite mound we could see several hundred. They were a remarkable sight feeding in the tall grass beyond a quiet pond full of pelicans, ibis and spoonbills.

By evening we were back in Malakal, and set off the following day for the Boma Hills 450 miles to the southeast close up on the border of Ethiopia. Most of this trip was through flat country. The flood plain of the Nile extends nearly the whole way so the open grasslands con-

tinued, varied by extensive areas of acacia bush. All along the road above the level of the flood waters were the villages of the tribes. Most were empty as at this season the people go with their herds for fresh grazing and only return when the rains begin. As elsewhere in Africa, it is the practice to set fire to the long dry grass to obtain fresh new growth for the cattle. Rarely were we out of sight of burned land and the effect was depressing. There were few animals.

Near Boma the road crosses a reserve where burning is somewhat controlled. Here we found White-eared Kob and Reedbuck and Oribi, but the herds were shy of the road and moved off quickly. The hilly region around Boma at times is filled with thousands of Zebra, Tiang (the

Elephants have destroyed much of the vegetation in the small and heavily populated Nimule Park. Grass is closely cropped and almost every tree broken off and browsed. But the Park still attracts tourists.

northern relative of the Topi) and Hartebeest. It was empty during our visit and we met with only a few giraffe, the odd Roan Antelope and sixteen Zebra. The road to the south was impassable, so that we couldn't search in that direction.

We returned to the Nile at Bor, across grasslands filled with small gazelles, and moved down to the town of Mongalla. Around here, too, the land is burned and over-grazed, and the animals are far back in the bush. We did see three herds of elephants, some seventy in all, moving to water late in the afternoon. Several were standing at a distance in a pond up to their knees, pulling up aquatic plants. They beat the bundles of vegetation against their legs to free the mud and slowly stuffed their mouths. Two reserves have been established in the area of Mongalla and contain a variety of species, but not in any number. The district is a popular shooting ground and the game is shy and dispersed.

The Sudan has three National Parks; one of 2,470 square miles near where the Blue Nile crosses the border with Ethiopia; another of 7,700 square miles in the southwest and the third on the Uganda border. This last is the Nimule National Park, lying between the Nile and the mountains to the west. It is only a narrow strip of country, barely a hundred square miles in all, but here we



saw the least disturbed animals in the nation. Uganda Kob bucks were stationed on their territories, the grass worn down to a circle of bare earth. The dark heavy shapes of Buffalo, like some unfamiliar breed of cattle, grazed in the distance. It was a new landscape. Smooth granite ridges covered with closely cropped grass rose from the edge of a swift stretch of the river. What trees there are have been browsed for years by elephants and look like the survivors of some radical pruning demonstration. Too many animals occupy too small an area, but the Park is nevertheless an important tourist attraction as well as a valuable sanctuary for a wide array of species. The White Rhinoceros is a conspicuous resident of Nimule. This northern race of the white rhino, which previously had been associated with South Africa, was not discovered until 1900. It is a social creature that usually is seen in small bands, but we were fortunate to see eleven in view together. They were feeding in a grassy swale and moved downwind toward the rocky outcropping which hid us from their view. A mother and calf came so close that we had to remove the long lenses from our cameras.

The Park is best at dawn. In the cool of the early morning, with the mist rising from the Nile, the air is filled with the songs of birds. The

elephants that come to the river at night are often seen in considerable numbers before they go deep into the Park for the day. Only four were still in view on the morning I was there but these permitted us to approach within twenty yards and to watch them casually feeding and rubbing their tusks on a fallen tree.

From Nimule we went east again to the Imatong Mountains, a range of volcanic peaks in the southernmost part of the country. In the high valleys is a large forest reserve which included a protected rain forest of mahoganies and tall gums and figs draped with vines and plants. Here, high in the trees, we saw the handsome black and white Colobus Monkeys following each other in single file from branch to branch, searching for food and stopping to peer down at us. This monkey is highly valued for its pelt which is used in tribal dancing costumes and also exported from parts of its range. The animal is protected in the Sudan, and as firearms are rigorously controlled, quite successfully. However, in Ethiopia it is hunted relentlessly and thousands of skins are sent to market every year.

We returned to the open plains to the north of these mountains and drove through country that once must have been filled with game. Only a few Oribi dashed away from the jeep. Like rab-

bits, this antelope can survive on degraded, burned-over land and compete with the native cattle that drive all other animals away. During the rains, much of this district is flooded and used by elephants, whose enormous footprints harden in the clay as the land dries and make driving hazardous.

Next we went to the west bank of the Nile. The river is crossed by ferry at Juba, the second town of the Sudan, and the head of navigation. The town is a strange mixture of mud huts, unimaginative institutional architecture and European houses. Most of the outlying streets, though, are lined with trees and gardens, a welcome contrast to the drier country we had left. From Juba we went north following the Nile along the edge of ground which is under water during the rains. On one side of the road were the grassy meadows stretching off to the bank of the river, and on the other thorn and acacia bush. This is a thickly populated part of the country and at every turn in the road we came to a village or herdsmen and their cattle. The major tribe of the area is the Dinka, a Nilotic people who have a cattle economy and by and large leave the wild animals alone. The cattle, of course, compete with the wildlife, but we saw less destruction of the habitat by fire and overgrazing in many parts of the country here on the west bank than on the east.

Our route swung more to the west as the flood plain widened and tributaries from the Congo divide joined the Nile or flowed out to become lost in the Sudd. We progressed perhaps 150 miles a day and sometimes much more. At places which promised interesting animals, we stayed over a day and looked for them. Usually it was the same. Too many cattle around or the game was reported too far off the road to reach.

When we were able to get a bit off the main road, if such a name can be given to the somewhat improved dirt track we followed, we saw evidence of a considerable number of animals, but nothing like the still large concentrations of East Africa. Elephants, in particular, seemed to range over most of the land we traversed. There were pockets of Tiang and Kob, and often family groups of Giraffe, the odd Waterbuck or Roan Antelope. In a sense we were rather frustrated by geography, for nowhere were we able to go far into really wild country to see what it held

except on foot, and there was little time. Nor were we equipped to travel any distance without our vehicles.

As we continued northward, the character of the country changed. The drier land carried larger trees and the river banks grew higher. At the Bahr el Arab, which means, "River of the Arab," the change was abrupt. To the south were the Dinka and their cattle, and on the north bank was an Arab village with horses and a few camels. We were in the Province of Darfur.

Just a few miles beyond the village the land became arid and sandy, and the vegetation changed. Thorn and the acacias associated with dry country became the dominant trees. Ostriches appeared in the open spots. Except for a handful of gazelles, we seldom saw animals from here on to the end of the trip — a few Baboons, Duiker, Vervet Monkeys, one young Kudu cow in the foothills of the Jebel Marra was all.

It is perhaps because this is the land of the Arabic tribes, born hunters who run down their prey from horseback, that there is so little game. These nomadic herdsmen have grazed this land for centuries and their number is increasing. Water is scant nearly everywhere and while this district is not true desert, not many species find it suitable to their needs. Further to the north, where vegetation all but disappears in a world of sun-baked rock and sand, other animals such as the Addax, White Oryx and Barbary Sheep are reported to occur in small numbers.

The Province of Darfur is distinctly different from the country to the south. The rainfall is limited to heavy downpourings in the summer months, when it fills the dry river beds, or wadis, to overflowing. The water rushes down from the higher ground, seeping into the dry earth so rapidly that several rains are needed to fill the streams, and they then flow on into the rainless plains and lose themselves in the sands. During the remainder of the year, water is available only from wells or ponds which are large enough to persist through the dry months. Only in the high country of the Jebel Marra, which is a volcanic massif rising 10,000 feet above sea level, are there streams that flow all year.

We were unable to go into the desert districts or to visit the mountains of the Red Sea Province. Nor did we see the National Park at Dinder on



By native custom, the skins of White-eared Kob does are used as wedding presents, resulting in abnormally large populations of bucks. A doe is on the right.

In this acacia grove in southern Darfur, almost every blade of grass has been eaten by the migrant cattle and goat herds owned by the Baggara tribesmen.



the Ethiopian border in the central part of the country. While the airplane has solved the problem of covering distances that until after the war took months, local transport is little better than it was then except on the rough and difficult dirt roads, and our time was limited. Neither were we able to complete our trip in the southwest, where various species of forest animals exist in the rolling, tree-covered hills along the Congo border.

Without having actually seen these large sections of the country it is of course impossible to draw any definite conclusions about the state of wildlife as a whole. Nevertheless, our trip, which exceeded 4,300 miles, uncovered various factors

influencing the future of the wildlife of the Sudan.

First, the variety of habitat provides a niche for a great many species, and with a few exceptions there is enough space available to insure against extermination if conservation is properly practiced. The same might be said of other parts of the world, to be sure, but the Sudan is a much larger country than most and pressures of expanding human population do not now appear as great. Much of the land, too, is unsuitable for the vast expansion of agriculture, that will-of-the-wisp which is pursued with such avidity in so much of the world. It is probably true to say that the Sudan has no shortage of food and may

well be the best-nourished country in Africa, so the compulsion to bring land under the plough is less pervading. There is room for National Parks and reserves of sufficient area to insure that none of the fascinating species disappear and where they can be conserved as a national asset for posterity.

Against this over-simplification of the situation, there are a number of factors which, for the present, present difficulties. Foremost is burning. Fire for centuries has been an integral part of the life of both hunting and pastoral tribes. The hunters use it to remove the grass, which often grows over ten feet tall, so that their quarry can be seen, or else attracted to the short new grass that springs up after a burn. The herders fire the thick, unpalatable growth for the same reason. Other and possibly more fires are caused by carelessness, which can only be described as apathy. Honey gatherers invariably set fire to the tinder-dry grass when they smoke out bee trees. The campfires of nomads and travellers are left to burn out or, as is usually the case, to turn into raging flames that sweep the countryside. The tribes that practice shifting agriculture also use fire as a tool to clear new pieces of land every few years for their crops, with the same disastrous results.

Fire is not always the enemy of wildlife. Even before man became the most numerous animal on the continent, fire was a natural occurrence and through the course of centuries most of the more arid areas were swept by devastating fires at one time or another. The difference is that now the same grasslands and bush country is burned year after year until the vitality of the soil is wasted and can only nourish coarse grasses and thorn that cannot support either the wild animals or cattle. Only the goat, an exotic species, is at home in such degraded land.

Poaching, which is taking a frightening toll of animals in other parts of Africa, is not a real problem in the Sudan. At any rate there is no black market for meat and the ivory trade is rigidly controlled. Offenders are severely punished when they are found, and the sentence is not just a few months of three meals a day in a comfortable jail as in some other territories.

Paradoxically, a present threat to the wildlife is the Game Law. Nowhere else in Africa today

is it permissible to shoot so much under license. One can even kill lion and buffalo with no license at all. Just a tourist visa will do. For sheer quantity, too, the Sudan is the place to shoot. On a Class A license, at a cost of £60, a hunter is allowed to kill over a hundred animals, even if it has to be done in a week. A resident can get the same license for a tenth the price. Only in the case of a few species is the limit, in an area where they are rare, different from that in places where they are plentiful.

This situation is not as ominous as it sounds, for the Sudanese officials are very much aware of the shortcomings of a licensing policy based on an Ordinance of 1935, and all applicants are carefully screened. Possession of firearms is also carefully controlled, and every owner of a rifle or shotgun is known to the Game Department. A permit is also required to purchase ammunition, and abuses of the Game laws result not only in a fine or prison term, but in the loss of gun and automobile if they are used to hunt illegally.

The regulations are — as in our own country — difficult to enforce. The shyness of the animals along the road is indicative of shooting from cars, but it must be admitted that the same thing happens in the Adirondacks. Fortunately, the Sudanese in government realize the problems and the values of their wildlife. All that is required is a more thorough knowledge of the needs and habits of the large variety of species so that they can be efficiently conserved. With such data, game laws can be drawn to insure adequate protection and to afford all the benefits that a wonderful natural resource can bring to any country.

In Africa, crises follow crises in the headlines and we forget that the Sudan has been an independent country for more than five years and is successfully managing its political and economic affairs.

The relatively stable economy and the level of education of a large number of the leaders in government make it possible for the country to make a real contribution to conservation in the continent. What must be brought home to them is that countries throughout the world are not respected and loved for their gross national product but for their people and their natural wonders. Very few travel to Switzerland to see the banks and the watchmakers!

EXIT TIMBER WOLF, ENTER COYOTE

By DAVE MECH

SINCE THE WHITE MAN settled the United States, he has persecuted most large predators and destroyed their habitat. Extermination was the usual unfortunate result. Lynx, Fisher and Marten populations were greatly reduced, and Mountain Lions, Timber Wolves and Wolverines were eliminated from the Northeast. However, here man unwittingly *helped* one large carnivore—the Coyote. Fifty years ago there were none in the Northeast; now there are thousands.

Many people might question, “Do you mean the small Coyote so familiar in the West?”

No, these newly-established animals belong to one of the largest Coyote subspecies, *Canis latrans thomasi* (or Brush Wolf), occurring as far west as Kansas. The average adult female weighs 25 to 28 pounds; males average 32 to 35 but sometimes reach 60 pounds. The color also varies. While most Coyotes are generally a mixture of black, gray and brown, individuals might be almost black or very light tan.

Trappers sometimes catch Coyote-like animals

The Coyote was long thought of as typical of the West; today it is equally representative of broad sections of the Northeast, where it moved in after extermination of Timber Wolves.

Photo by E. P. Haddon, U.S. Fish & Wildlife Service





with almost pure red and white fur, but these are undoubtedly hybrids with dogs such as collie, German shepherd and airedale. This pollution of the Coyote strain usually occurs on the outskirts of the animal's range, where dogs run freely. Some of the hybrids sport such dog-like characteristics as dew claws on the hind legs, floppy ears and curly facial fur. In addition, the "coy-dog" is usually larger than the Coyote, sometimes reaching 70 pounds. On the whole, these are much less common than pure Coyotes.

How did the first Coyotes get here? No one really knows, but there are a few theories. One is that trappers brought them to create a population for which they could get bounties. Another is that they were bought as pups, for pets, and when they grew too large, were released. Probably both theories account for *some* Coyote records in the East, but the present established population is probably a result of natural movement.

As timber resources and Timber Wolf numbers diminished in Michigan, Wisconsin and Minnesota, the few Coyotes there gradually increased. The species probably became firmly established in Michigan about the turn of the century. Ontario reported its first Coyote in 1919, and soon they were found throughout the province. Then they might have crossed the ice of

Top — A Coyote brings a Jackrabbit lunch to its pup at the den. (E. R. Kalmbach photo). Right — Doglike tracks of the Coyote now appear on old woods roads and paths in the Northeast wild areas. (Mech photo).

the St. Lawrence River and entered the Adirondack mountains of New York. Indeed, one was recorded there in 1925. In the mid-thirties, a second was killed and there were reports of others south of Saratoga. About 1942 populations became established in the Adirondacks and in that year the first Coyote in Vermont was taken.

New York populations occurred in seven areas, mostly on the St. Lawrence side of the Adirondacks. In ten years, the state's Coyote range expanded from about 700 square miles to 16,000. By 1955 the animal occupied not only the entire Adirondacks but the whole northern third of the state. There are now records of Coyotes in southern New York State, the latest from a few miles northeast of Norwich.

Meanwhile the species continued to spread from New York. In Vermont the Coyote has been recorded from nearly all of the 14 counties; about 20 are killed there annually. New Hampshire reported a single Coyote in 1944, and a den of Coyote-like pups and an adult in early 1960. The first Coyote showed up in Massachusetts in 1957.

In 1958 three other specimens were trapped in the central part of the state, and at least two others still roam the area.

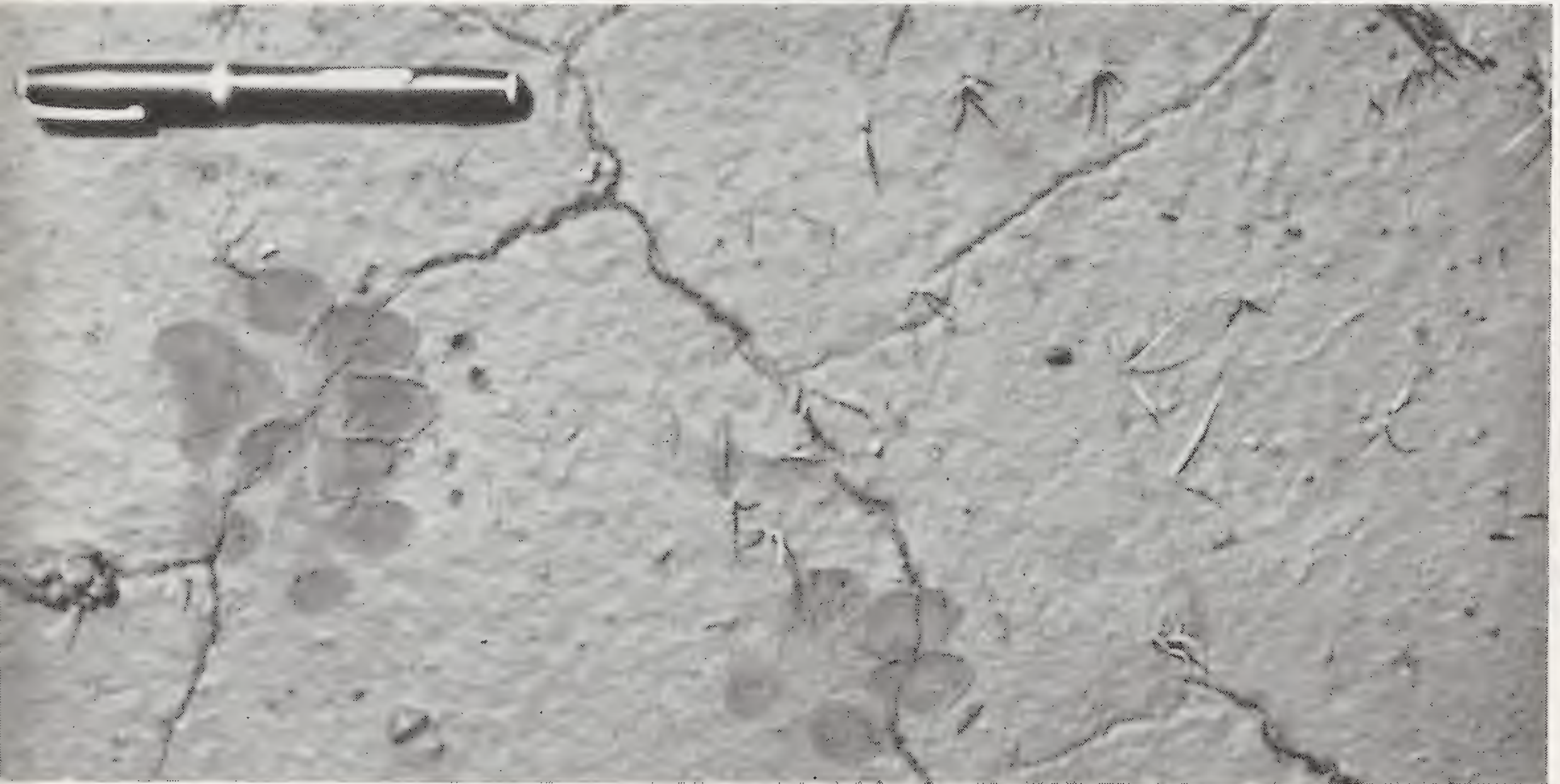
Between 1945 and 1953, New Jersey had four Coyote records; recently another animal was taken. Pennsylvania now has a small Coyote population in the Poconos, and last summer a den of seven pups was found in Cameron County.

Now that the Coyote has become established in the Northeast, how will it affect other wildlife? Some people's first thought is that since the creature is a predator, it *must* be doing damage. However, is this necessarily true? A scientific look at the Coyote in New York, for instance, reveals many interesting facts that casual observation will not. While game biologists do not deny that Coyotes kill deer, they ask us to take

exceeding their food supply and ruining future browse. Thus every deer killed helps alleviate this sad situation. (See "Our White-tailed Deer Problem" by Milt Stenlund in *Animal Kingdom*, July-August, 1959).

Coyotes seem to depend much more on the prolific rabbit and hare for their food supply than on deer. It was during the upswing of the Snowshoe Hare population in New York that the Coyote increased; and the carnivore seems to be more common in areas of high hare concentrations. Food-habits studies on thousands of western Coyotes prove the species feeds heavily on rabbits and hares. Studies in New York show that squirrels, mice, carrion, berries, and beechnuts also form a large part of the Coyote's diet.

I shall never forget the looks of several Adiron-



a broader look at Coyote-deer relations. They point out that despite the increasing numbers and range of the Coyote from 1942 to 1954, deer hunting improved; reported buck-kill almost doubled. Similarly in Michigan, where for years bounties were paid on almost 3,000 Coyotes annually, the deer population continued to increase. Although Coyotes sometimes kill deer, they do not control the population.

Whenever Coyotes prey on deer in the Northeast, they probably are *benefiting* the deer herd, anyway. Herds in most northeastern states are

dack deer hunters one fall when I examined the digestive tract of a "big bad wolf" one of them had killed. They fully expected the tract to be crammed with deer hair. Were they startled upon seeing that it was packed solidly with beechnuts — and 14 inches of clothesline! Before, the hunters thought Coyotes ate only deer; now they believe the animals eat only beechnuts — plus an occasional piece of clothesline, of course.

Because its diet includes some game species, the Coyote has attained a bad reputation in some circles. Unsuccessful deer hunters find it consol-



Here is where you are likely to find the Coyote — in remote and brushy, forested mountains and hills in the Northeastern U. S.

Photo by the author

ing to blame the predator. Snowshoe Hare hunters condemn it for taking what is “theirs.” Many well-meaning but misinformed citizens believe all predators should be exterminated. Therefore New York has been pressured into Coyote control programs, and many counties offer a \$25.00 bounty.

While more than a hundred Coyotes are taken annually in New York alone, the control programs have shown only one thing — the Coyote is here to stay! It is a wise quarry. Many a trapper has found his trap dug out and the bait stolen because the trap was not completely free of human scent. Not only is the Coyote smarter than the proverbial fox, but it also travels like a salesman. Moving into an area, it remains a few days, then moves on. Ten days might pass before it returns. One Coyote which was live-trapped, ear-tagged and released by New York biologists was recaptured 22 miles from its first capture point. Thus a trapper may see Coyote tracks and set a trap or two, but chances are the animal is several miles away. A third reason why Coyotes are difficult to control is that much of their range is relatively inaccessible. They prefer remote, brushy or lightly-forested mountains and hills.

Coyotes trapped are rapidly replaced since each breeding pair bears an annual average of six

young. A pair often remains together for years, breeding each February. The young are born 63 days later in an abandoned woodchuck hole or fox den which the female enlarges, or in a hollow log, stump or rock cave. They open their eyes after about two weeks and appear at the den entrance a week later.

Both parents feed their offspring, often carrying prey for miles. About early July the pups venture forth on hunting expeditions with their parents. By mid-fall when they are almost full grown, they strike out on their own. Tagging studies show that one year later the young Coyotes have dispersed to an average of 25 miles from their den. Some have been found 250 miles away. It is easy to see how the Coyote range increased so rapidly. It is also easy to see that this handsome newcomer will remain here in the Northeast for many years.

Thus it took nature only about 60 years to fill the niche left by the extermination of the Timber Wolf. Those of us who mourn the loss of the Timber Wolf welcome the establishment of the Coyote. Now again a wilderness camper can sit by his campfire in the Northeast and listen to the yips and howls of a canine chorus — a chorus advertising nature's contempt for man's interference and boasting of her new triumph!

News from the Conservation Foundation

Arusha African Conference

In 1959 Dr. F. Fraser Darling made a protracted tour through fourteen territories of Africa, gauging opinion on the idea of a conference at a high level for discussion of the value of African wildlife for the peoples of Africa. Wildlife is not only one of the principal assets for tourism, but, as Dr. Darling and others have pointed out, the animals can be carefully harvested to augment the food supply. Furthermore, wild animals themselves have great value in maintaining the rather tender vegetative cover of much of tropical Africa.

The proposal for a conference was taken up by the International Union for the Conservation of Nature, and at the IUCN conference in Warsaw last year a special project for Africa was launched. A tour by Mr. Watterson, Secretary-general of the IUCN, through the independent African territories, to be followed by a conference in Arusha, Tanganyika, in September of this year, was decided upon. The New York Zoological Society contributed to the IUCN for Mr. Watterson's tour, and Dr. Darling will attend the Arusha meeting as the representative of The Conservation Foundation. He will present a background paper on habitat as part of the conference's technical session, which is scheduled to deal with the present role of natural resources, their research, conservation and development, and the place of nature and conservation in land-use planning. A general session will emphasize wild natural resources as economic and cultural assets, and will discuss local and world attitudes and programs for conservation development and education.

Population Symposium

The Foundation has long held the belief that the world-wide significance of steadily increasing population pressures on all phases of man's environment and future well-being is too little understood. Acting in this belief, the Founda-

tion is now gathering statements on the importance of the problem, to be published as a book by Doubleday & Company. The contributors, all outstanding leaders of thought and action in various fields of human endeavor, will write concise statements of conviction on the implications of growing population pressures in areas of their special interest.

Among the eminent writers who have accepted to date are: Marston Bates, Henrique Beltran, Eugene R. Black, Lord Boyd-Orr, Grenville Clark, Henry Steele Commager, F. Fraser Darling, Rev. Robert I. Gannon, S.J., Robert M. Hutchins, Aldous Huxley, Sir Julian S. Huxley, Joseph Wood Krutch, Walter C. Lowdermilk, André Maurois, Frederick H. Osborn, Bishop James A. Pike, S. Radhakrishnan, Earle L. Rauber, Paul B. Sears, Irene B. Taeuber, Arnold J. Toynbee and Sir Solly Zuckerman.

Briefly Noted

Dr. Osborn has accepted an invitation to write an article on "The Problem of People: Pressures of Population on Our Whole Way of Life, As Envisaged 25 Years Hence" for the 175th Anniversary celebration of the Pittsburgh *Post-Gazette* . . . In "Plunder or Plenty?" the lead article in the *Saturday Review* for April 15, Samuel H. Ordway, Jr., outlined attitudes on conservation over the last century and a half, as exhibited in books and essays, and pointed out the need for practical application of general conservation theories . . . The June edition of *Vital Issues*, published by the Center for Information on America, will be devoted to an article on "Conservation and Pest Control: How Best Can Both Operate Together?" contributed by Dr. Darling for The Conservation Foundation . . . Wallace Bowman represented the Foundation at the Second National Congress on Environmental Health at Ann Arbor, Michigan, June 6-8. Mr. Bowman has also accepted an invitation to attend a Cornell conference on the problems of suburban growth, in Ithaca, N. Y., June 15-16.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Mr. Conway Becomes Director of the Zoological Park



WILLIAM G. CONWAY

The appointment of William G. Conway as Director of the New York Zoological Park was announced on June 8 by President Fairfield Osborn.

Mr. Conway came to the Bronx Zoo on November 15, 1956, as Associate Curator of Birds and was made Curator of Birds at the beginning of 1958. Since June 2, 1960, he has been Associate Director of the Zoo.

Zoo management has been a life-long interest of Mr. Conway's since, at the age of 18, he began working at the St. Louis Zoo to pay for his education at Washington University. Subsequently he was for six years Curator of Birds at the St. Louis Zoo. Specializing in Zoo management, he has studied operations of every major Zoo in the United States and many in Europe, has written many technical articles on Zoo operations, and has been called in as advisor to Zoos in Colorado Springs, Boston, Evansville, Detroit, Washington, New Orleans and Kingston, Jamaica.

Since being at the Bronx Zoo, Mr. Conway has taken a leading part in devising the current ex-

pansion program of the Zoo and in planning novel buildings and exhibits.

Dr. John Tee-Van, General Director of the Zoological Park and the New York Aquarium, will continue in that position.

Judy Brown's "Noah's Ark" on Exhibit in the Zoo

Over the years the Zoological Society has had many animals-in-art exhibits in the Heads & Horns Museum in the Zoological Park — animals in wood and stone and ceramics, on paper and canvas, created by carving and chiseling and molding and painting. But never created by the welder's blowtorch until now, when we have opened a summer exhibit of work by Judy Brown.

The animal figures that ride a large wooden ark — there are 25 pairs of them, ranging in size from elephants to mice — were literally created by a blowtorch and melting metal rods, a technique for which Miss Brown is noted.

The Zoo's exhibition was featured (in color) on the cover, and in an article, in the May 14 issue of *This Week* magazine.

IN BRIEF

Award for Monograph. The monograph called "The Bighorn Sheep in the United States, Its Past, Present, and Future," by Dr. Helmut K. Beuchner, has been given an award for "excellence in reporting research in the field of terrestrial wildlife management" by The Wildlife Society. The work on which the monograph was based was done by Dr. Buechner for the Zoological Society and The Conservation Foundation, and it was published in May of last year. Copies are available at the Publications Office, the Zoological Park, New York 60, N. Y., at \$1.50.

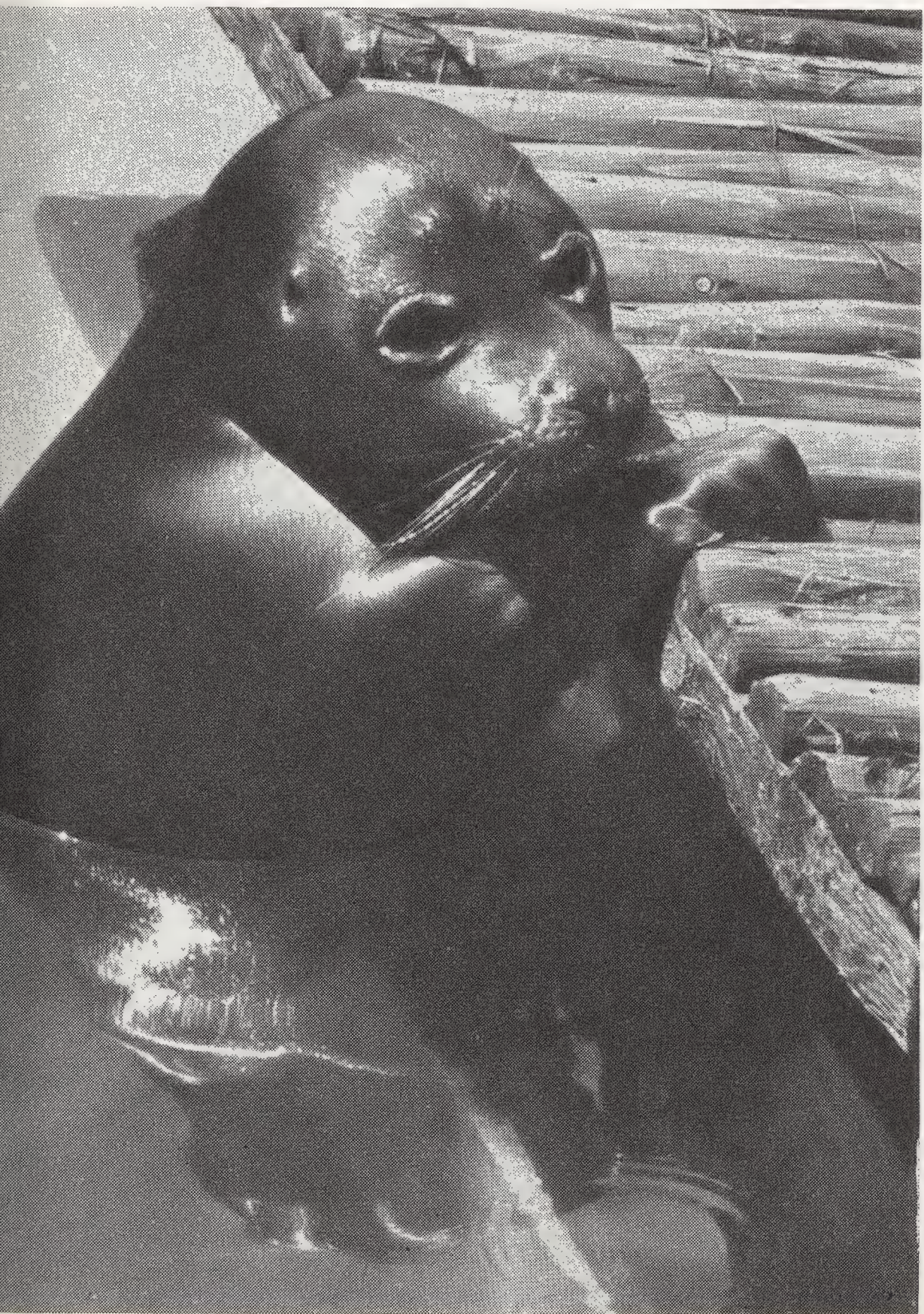
Wheatear at Sea. A European Wheatear flew exhausted onto the North German Lloyd liner *Bremen* on the night of April 19, while the vessel

was in the English Channel. Such havens for stray birds have often produced interesting specimens for the Zoo's collection in the past — and the Wheatear is the latest, for it was rescued by Erich Harken, one of the stewards, and cared for until the *Bremen* reached New York. We now have it in the collection — the first European Wheatear we have exhibited in 27 years.

The Walrus Complex. The name does *not* refer to a psychological state — merely to the series of three pools being built at the Aquarium at Coney Island for Olaf and Ookie, our Atlantic and Pacific Walruses. Work has continued all spring and the pools are advancing rapidly. Two large ones will be for exhibition and a smaller pool in the “complex” will be used for isolation. Seals and other aquatic mammals may be kept in the pools if necessary. Work is also moving ahead rapidly on the filtration and water-treatment system for the large Oceanic Tank. Another new exhibit is botanical in nature — a planted area showing the plants normally found on beaches and sand dunes along the North Atlantic coast.

John Curran of “Newsday” made this picture of a Baikal Seal at the Aquarium. It was shown in the International Zoo Photo Contest, Chicago.

Photo courtesy of “Newsday”

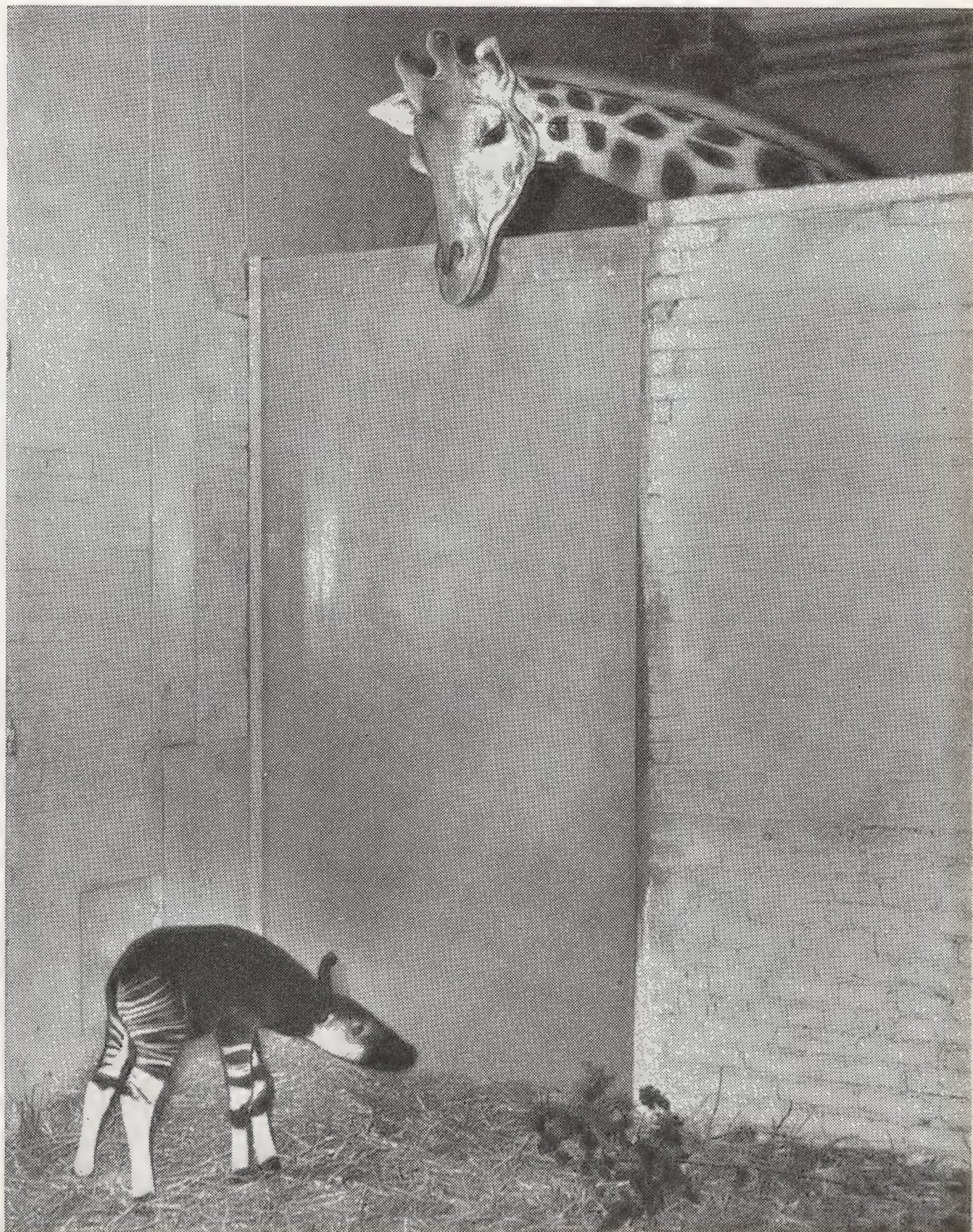


Python Eggs Again. A female Indian Rock Python in the Reptile House collection laid 21 eggs in a “nest box” in the corner of her compartment on April 5 and for a few days we had hope that they would hatch. Subsequent examination showed that most of them spoiled during the first week, however, because of highly fluctuating temperatures on the floor of the compartment. Curator Dowling made precise temperature measurements in the reptile's coils, on the floor, among the eggs, and in the surrounding air and found that the python maintained a temperature 10 degrees above the minimum around her. She apparently is able to do this by means of periodic muscular contractions. Her temperature stayed at 90 degrees.

For Children. The Children's Zoo reopened for the season — its twenty-first — on Saturday, May 20, and the Farm-in-the-Zoo reopened on Sunday, June 4. A special feature of the Farm's opening was the presence of Miss Bonnie Sue Houghtaling of Swan, Iowa, the “1961 American Dairy Princess.”

“What's Buzzin', Cousin?” by Photographer Jim Nightingale of “Newsday” was made at the Bronx Zoo, won an Honorable Mention.

Photo courtesy of “Newsday”



PUBLICATIONS OF INTEREST

WHY FISH BITE AND WHY THEY DON'T. By James R. Westman. 211 pp., 40 drawings. Prentice-Hall, Inc., Englewood Cliffs, N. J. 1961. \$3.95.

Angling is much more of an art than a science, but Dr. Westman, who is an experienced fisheries biologist as well as an expert angler, is convinced that a more scientific approach to the sport would provide fishermen with greater satisfaction — and more fish. Dr. Westman makes his point with humor and insight, and he backs it up with concrete advice on when and how to fish. His tips alone should be worth the price. — J. W. Artz.

LIVING FISHES OF THE WORLD. By Earl S. Herald. 304 pp., 145 color and 149 black-and-white photographs. Doubleday & Co., Inc., Garden City, N. Y. 1961. \$12.50.

This handsome volume lives up to its ambitious title; it does present a descriptive account of all the different groups of fishes alive today. It is the most complete survey of the fishes ever written in non-technical English and is beautifully illustrated by the finest collection of fish photographs ever assembled. We are pleased to note that 17 of these are from the Zoological Society's files, mostly taken by Staff Photographer Sam Dunton at the New York Aquarium. — J. W. Artz.

LISTEN, THE RED-EYED VIREO. By Milton White. Illustrated by F. B. Modell. 96 pp., many drawings. Doubleday & Co., New York, 1961. \$2.75.

Every bird-watcher will approach this seemingly irreverent little book with apprehension. We don't like to have our hobbies made fun of, after all. But in a very few pages it appears that the story of a young college professor being introduced to bird-watching is not irreverent; in fact, a great revelation comes to him. It is a funny book, a true one, a real delight. And the jocose-affectionate illustrations by a *New Yorker* cartoonist are just right. — W. B.

SERENGETI SHALL NOT DIE. By Bernhard & Michael Grzimek. Introduction by Alan Moorehead. Translated by E. L. & D. Rewald. Many photographs in color and black-and-white. 344 pp. Dutton & Co., New York, 1961. \$6.95.

A fighting, informative, persuasive book about the great Serengeti Plains in Africa, by the Director of the Frankfurt Zoo and his son, to whom conservationists owe eternal gratitude. Michael Grzimek lost his life in an airplane accident over the plains; Dr. Grzimek is carrying on the fight with his writing and magnificent motion pictures. A book that every conservationist with an interest in Africa should own.

GALAPAGOS. The Noah's Ark of the Pacific. By Irenaus Eibl-Eibesfeldt. Translated by Alan Houghton Brodrick. Many photographs, end papers in color photos. 192 pp. Doubleday & Co., New York, 1961. \$3.95.

A readable account of present-day conditions on the islands that Darwin made famous, by the man commissioned to select a site for a biological laboratory there during the Darwin celebration.

New Members of the New York Zoological Society

(Between March 1 and April 30, 1961)

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Founder

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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Outlook for Our Wildlife

THE TIDE HAS TURNED somewhat for the better for the wildlife of our country. There are strong counter-currents, to be sure, but the situation as a whole is more hopeful.

A dozen years or so ago an editorial on this page, written in this same wondrous region of the Teton Mountains as the present one, stated that the future of some of the great mammals of the West was becoming increasingly critical. Developments in the intervening years have put a brighter color on that earlier somber opinion. The encouraging fact is that we Americans have become considerably more "conservation" conscious — just in the nick of time, it might be added. "Wild-life protection" has become a *cause*, drawing to it many groups of conservationists and sportsmen. Our game laws have improved, fostered by general public support. Our National Parks, containing extensive regions where wildlife is undisturbed, have become firmly established in the public mind as heritages that must be preserved. Consequently, whether in the Park or in numerous regions outside them, the populations of large animals — elk, moose, deer, buffalo, mountain sheep and antelope — are fairly well stabilized and the threat of extinction is certainly not imminent.

On the other hand there are "weak-spots" such as the status of the famed Grizzly Bear of the West and of those equally remarkable animals, the Gray Wolf and the Timber Wolf. Nor is the perpetuation of some species of waterfowl secure, because of the wide-spread draining of their marshland feeding grounds for conversion to other purposes.

The moral of the situation as a whole is only too evident — *the battle for conservation is never ended.*

Fairfield Osborn

ON THE COVER

The Grizzly Bear on the cover is named "Sylvia" and she was presented to the Zoological Park by the National Park Service because she showed too much interest in visitors in Yellowstone National Park. Fearing that her familiarity would lead to a serious accident, Park rangers had her deported. She is now on exhibition in a den adjacent to the Penguin House, alongside another Grizzly female that came to us in 1930. "Sylvia" seems to be perfectly at home in the Zoo, where she can see all the visitors she wants — but without being able to do them harm.

SMITHSONIAN
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AUG 30 1961



FROM THE TOP
OF THE WORLD
TO THE AQUARIUM

Three Baby Walruses and the Smallest Seal

By CARLETON RAY

Assistant to the Director, New York Aquarium

ON THURSDAY, MAY 25, the Aquarium's 1961 Walrus Expedition came home from Gambell, Alaska, 38 miles off the Siberian coast in the Bering Sea. As it turned out, there are three baby walruses and a couple of delightful Ringed Seals in the Aquarium's Tripool to testify to its success. But it was not a holiday romp to the wonderlands of our forty-ninth state. Far from it.

Usually it is not difficult to capture a wild animal — not difficult compared to the problems of getting there, finding out what to do with your captive once you have it, and then getting home.



The walrus is a good example. Many have been captured over the years. Young ones are easily handled, intelligent and adaptable, but they are found in remote places and their dietary requirements are challenging. Of all the captive walruses, most have died in the first months and not one has grown to anything like the size attained in nature. There is one exception-in-the-making: Olaf, the big Atlantic Walrus at the Aquarium. His 1,400 pounds are about normal for his age, five years, and only he has grown significant tusks. Young Ookie, the female Pacific Walrus at the Aquarium, is another exceptional animal, for prior to 1959 no walrus brought

to this country when under the age of two months had lived for a full year. Ookie was captured at Gambell in 1959, and is thriving. Diet seems to be one key to walrus success.

The rest of this article is edited extracts from my field log of the Aquarium's 1961 Walrus Expedition.

Monday, May 8. I finally took off at 3 p.m. for Anchorage, 3,550 miles from New York, via Chicago and Seattle. Baggage: suitcase, 16 mm. movie camera, tape recorder, still camera, guitar, copy of "Of Human Bondage." Freight: skin clothing and cold weather gear, walrus medications, baby bottles, stomach tubes, meat grinder, sleeping bag, 350 lbs. of frozen smelts and clams on ice, 10 animal crates — a total of 1,094 lbs. This date is more than two weeks later than planned departure and the ice in the Bering Sea is fickle; it doesn't wait.

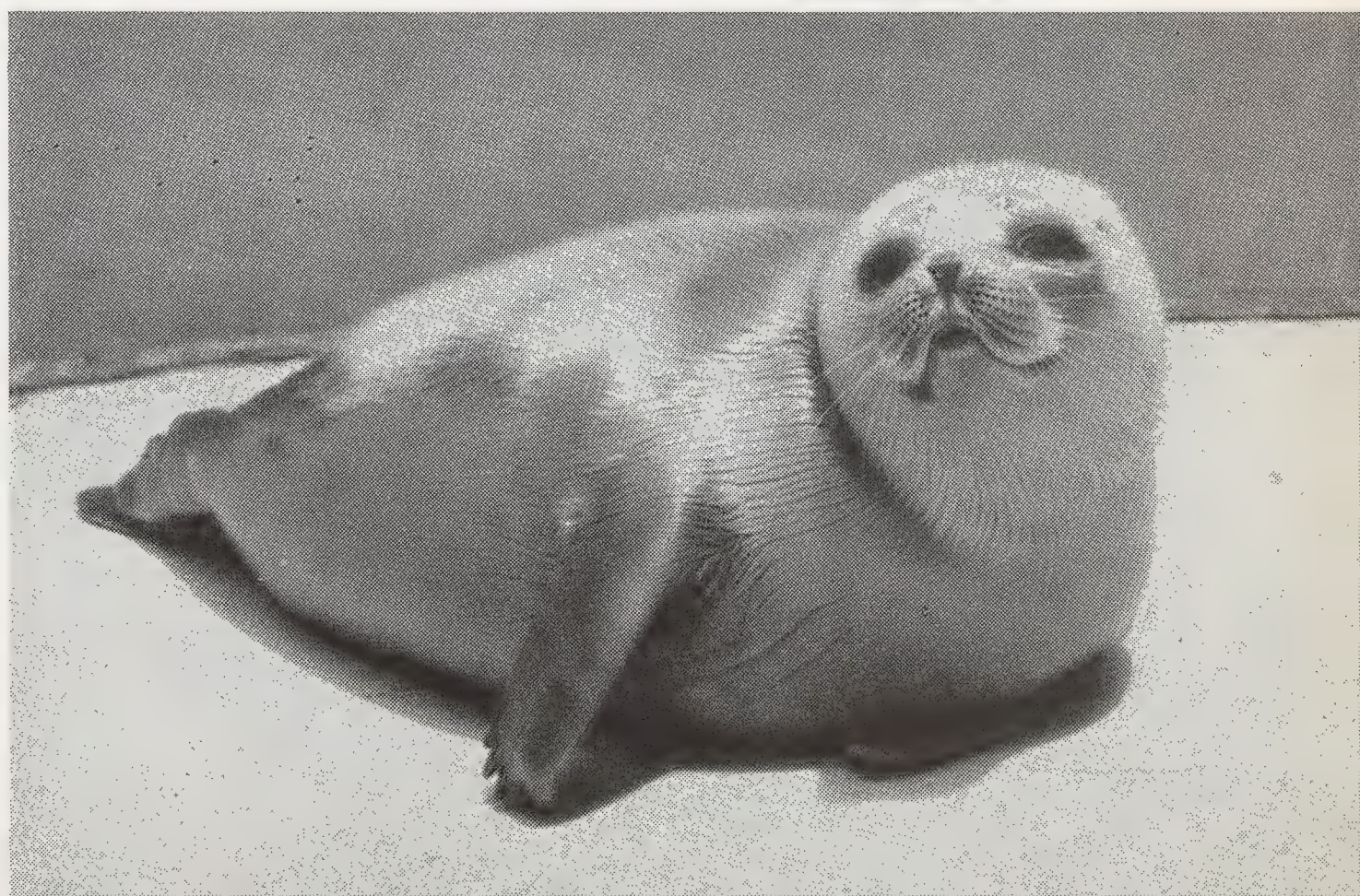
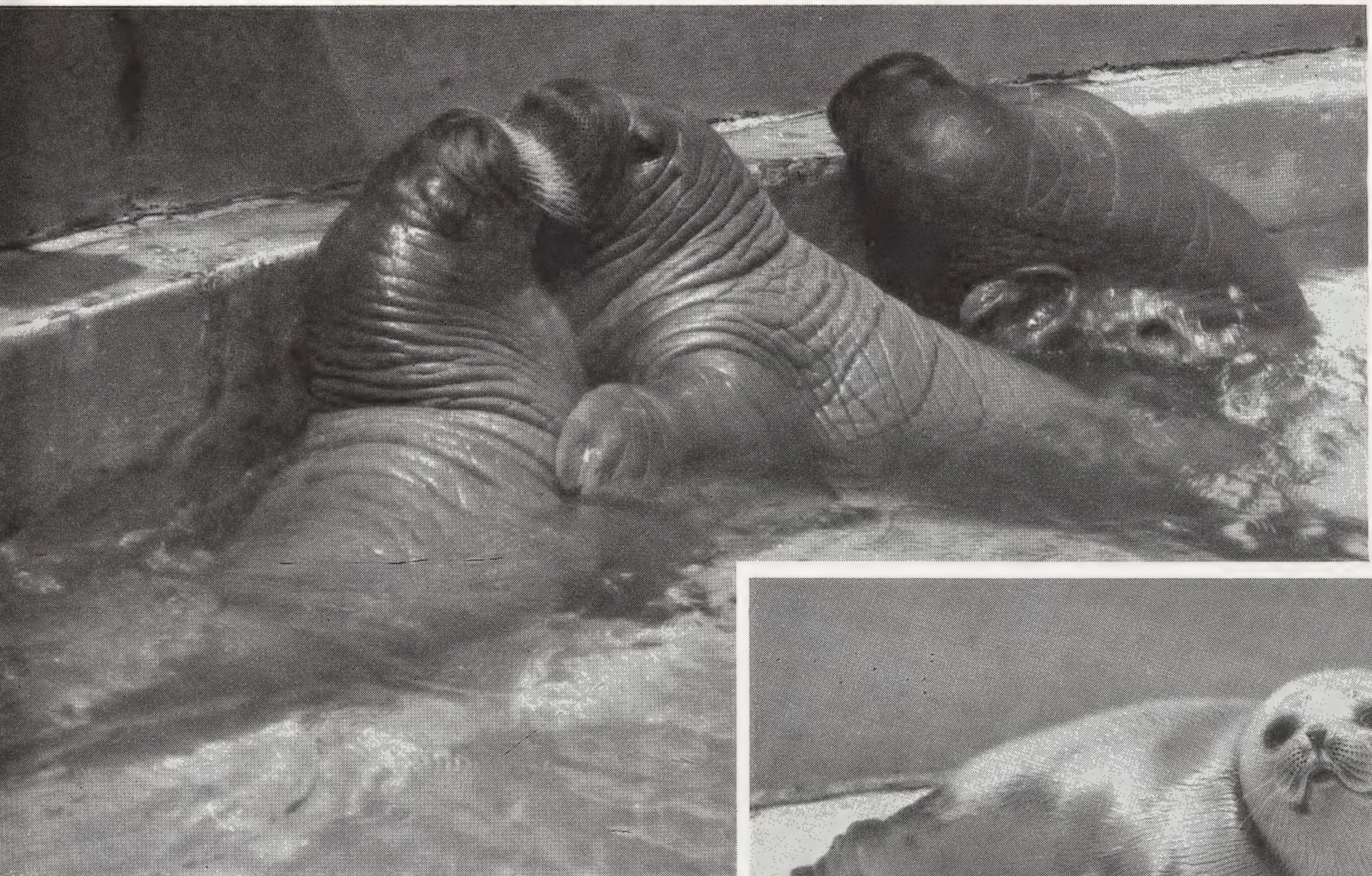
In Anchorage as the sun is setting, nearly 10 p.m. The mountains and glaciers of the Kenai and Chugatch are held in the purplish-pink alpenglow and the air is crisp and seems to hold more oxygen — so different from the smog of the concrete-decked landscape I left a few hours ago.

Dick Zinsmann of the U. S. Public Health Service's Arctic Health Research Center is at the airport and says he is taking his annual leave in order to join me for two weeks in Gambell. This is a break, for I'd be hard-pressed to do this job alone.

Tuesday, May 9. Up with the sun at 4 a.m. for a before-breakfast stroll, after which I find that all the freight is still in Seattle. I had been assured that it was transferred with the passengers when a cracked windshield forced us to change planes in Seattle. I hope someone has the gump-tion to keep the fish and clams out of the sun.

But the weather has Nome socked in, so we couldn't leave Anchorage today in any case. A time-saver for walruses is on the market; bottled cream with 30% butterfat. This will supply about two-thirds of our starting diet. It's in good supply, so I bought a week's rations for four animals, 69 quarts at a cost of \$105.63.

The three little walruses swim together, playfully nuzzle each other — in fact, most of the time they are inseparable. Inset picture shows one of the two small, delightful Ringed Seals.



The entire New York Philharmonic Orchestra is in Anchorage tonight.

Wednesday, May 10. Weather allows an early afternoon takeoff for Nome, 450 miles northwest. My freight arrived, but had to be left behind in Anchorage because of a full load. Travelling with frozen foods doesn't permit shipping ahead, and now we have missed the weekly flight from Nome to Gambell. A charter flight is the only way out. It won't help the budget.

Over Norton Sound the ice is packed in solidly, a peculiar condition. Our charter pilot in Nome, Dick Galleher, says the ice extends out 100 miles to St. Lawrence Island, then opens up until at Gambell there's little left. The walrus season is well advanced at Gambell and Savoonga, plenty of females and young having already been caught. This can only mean that the breakup was early and that wind and currents have swung the ice east of its normal path at Gambell, a situation that isn't good for us.

Thursday, May 11. Weather marginal at Nome, clouds thick but high enough for a noon departure in Galleher's Aero Commander for Gambell, a bit over 200 miles west-southwest. Clams, fish, cream and crates are still in Anchorage but Dick will see to it that they reach us at the earliest possible moment. I bought extra cream and frozen scallops in Nome, just in case.

Over the Bering Sea, the ice is solid to Northeast Cape. At Savoonga it is abundant, with good leads through it and we can see walruses and seals on it. Very little ice at Gambell. We land just as the Marineland of the Pacific Arctic Expedition is leaving, nine men and their own plane, led by David Brown. We were to have preceded them and I can't help being envious of their four fine baby walruses. With the formulas developed by the Aquarium and the San Diego Zoo in past years, they should raise some fine animals. Winifred James, our hunter from the expedition that produced Ookie for us, caught Marineland's quartet.

Dr. Francis H. Fay, a friend and former associate, of the Arctic Health Research Center, will stay to help us, as he has in the past. There are a lot of walrus problems to be discussed with Bud Fay. Winnie, incidentally, tells me he already has a little bull walrus, a Bearded Seal (mukluk) and a yearling Ringed Seal for us as a starter.

Later today I learned that luck is still against us. A stray dog attacked and killed the Ringed Seal before it could be moved to an isolated hut. But the mukluk and the walrus were transferred safely and we have just left them sleeping cosily together in a corner. We have named the walrus "Aivok," the Eskimo name for walrus. He's not more than two weeks old.

Friday, May 12. Fed Aivok a trial breakfast of a pint of the formula — by stomach tube, a prelude to training on the bottle. The mukluk took two quarts from a bottle. A seal that doesn't know how to bite is a revelation to me.

Weather and ice are marginally good enough for a hunt and so at 9:30 a.m. we are off in Winnie's skin boat, heading northwest directly toward the tip of Siberia. Plenty of mukluk and their young on the scanty sea ice, but the babies are old enough to be wary. Mukluk dive peculiarly, throwing their flippers in the air to dive with a splash, quite like a frightened walrus.

Bull walruses are finally encountered 20-25 miles out, past the third thin line of ice. Winnie is after meat for his family and since the day was ending and his gas low, he shot the first two huge bulls we encountered. Both sank. More than half the walruses are lost this way, but the rest keep the Eskimos in meat.

On the way home we cross the International Date Line again, slipping from tomorrow into today, and console ourselves with pickled muktuk (blubber in vinegar), dried fruit and tea. The temperature is only 20 degrees, but feels much colder.

Back in Gambell at 8 p.m. Lane Iyakitan has a very small Ringed Seal, 11 pounds and not over a week old. The appearance of pups of the smaller seals — Ringed, Ribbon or Harbor — together with female walruses, signifies the approach of the season's end. Dick Galleher brought our freight up from Anchorage today, so we are well equipped again.

The mukluk is still taking 2 quarts of formula, falling asleep quickly afterward. Aivok has digested his breakfast, gets 72 ounces more, and goes to sleep with his head resting on the seal. But he is weak and has a slight cough, so he'll bear watching and maybe antibiotic shots.

Saturday, May 13. Strong northeast wind, no sun, no ice, no hunting.



Facilities for feeding are not ideal. Water is hauled up from the lake in garbage pails, by local boys with a dog team, and then boiled. Dick and I grind clams, warm cream over the gas stove, run over to the Aningayous to get the generator turned on, blend cream and clams. Then it's time to dress in walrus-proof clothing, clean the Jamesway hut, feed the animals, clean the hut again, play with the animals and make observations, and finally wash the dishes. Sometimes we're finished in an hour and a half.

We know that a baby walrus may consume about 10% of its body weight of formula each day. A baby seal seems to need up to 20%. Our feedings are patterned on these percentages and all ate well today.

Sunday, May 14. Still the northeast wind, estimated 20 m.p.h. The sea is picking up and there's no ice.

Mukluk's appetite has slowed down and Aivok continues weak. It is damp, unseasonably cold, and we can't keep the animals as dry as they usually are on the ice.

Monday, May 15. The Ringed Seal was dead this morning. Mukluk is sluggish and Aivok still weak. Something's amiss, but we can't pin it down. In previous years we kept young walruses and seals in out-of-doors pens with no difficulty, but this weather is much worse than it

Twenty-five miles northwest of Gambell, across the international date line, the hunters saw two huge walrus bulls on the ice. They became alarmed and dived a moment later.

From motion picture by the author

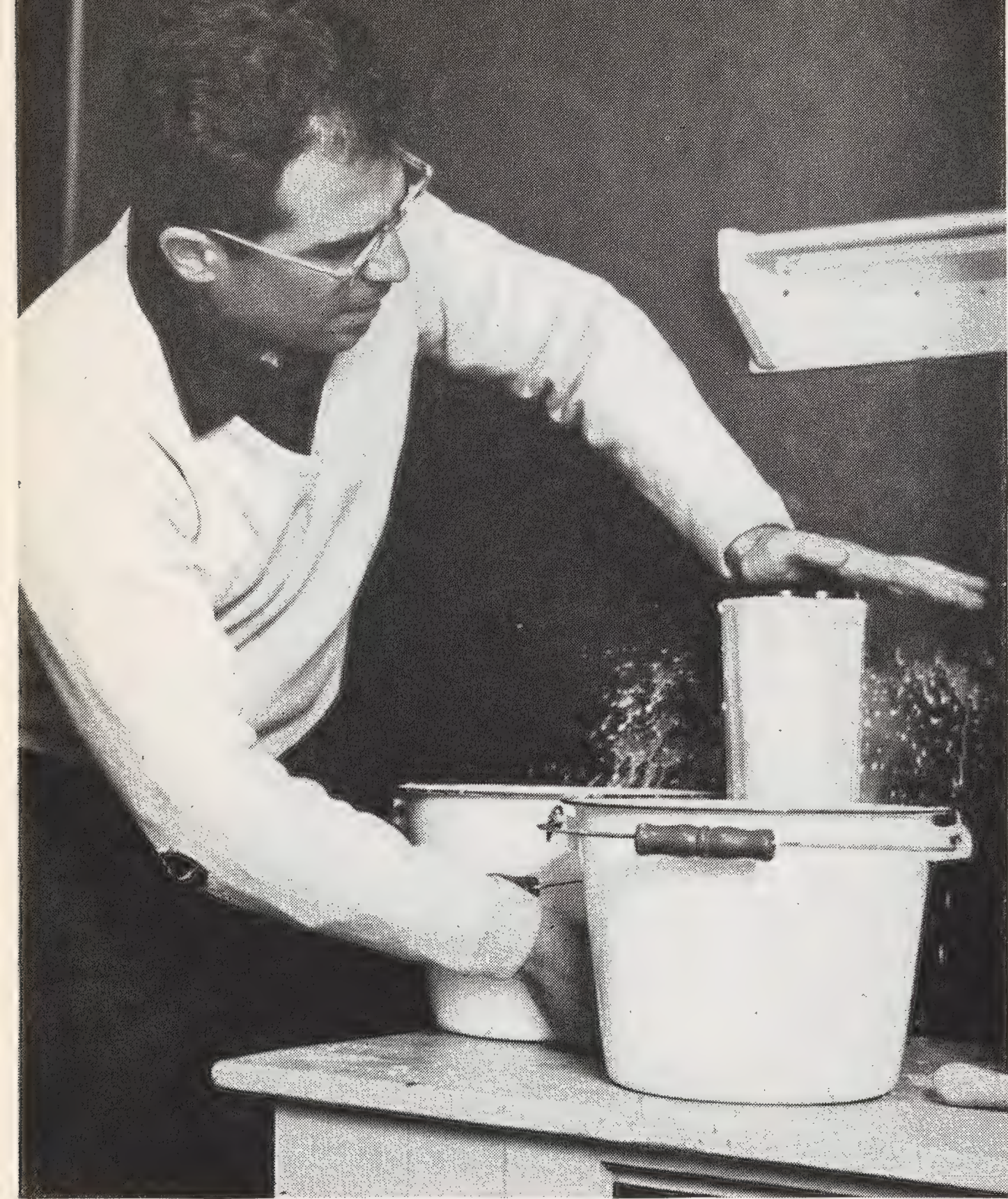
was then. We're taking exceptional care in the cleaning, sterilization and drying of the hut twice a day, for fear of some unknown infection.

Eskimo dance this evening. The sole instrument is a drum of thin skin stretched over a hoop 16 inches in diameter. At sunset it turns colder and windier and the snow begins.

Tuesday, May 16. Snow and gusts to 50 m.p.h. Bud Fay says you can figure 2.7 bad days to every hunting day. We are about due for a hunt.

The mukluk is dead, but this one solved the problem for us. A seal can be all right out on the ice in this horrible weather, but in the warmer Jamesway hut, slightly damp most of the time, there is too much heat loss. The diet problem we think we have solved; now we must find the thermoneutral point for seals and walruses, the temperature at which least energy is dissipated as heat. Certainly it will be higher and drier than the 35 degrees of the hut. It is a tragic fact that we most often learn through failure.

Immediately we set about getting Aivok dry, for he seems to be growing weaker, even though he has gained 3 lbs. since May 14. We put him



Above — Blending thick cream and clams to feed the walruses was a daily chore. Right — Feeding Aivok, the first walrus, by stomach tube was a prelude to training him to feed from the bottle.

Photos by William B. Bacon, III, Fairbanks



in a slat-bottom crate and soon he is dry and warm to the touch. He fell asleep immediately after his afternoon meal.

Between feedings, Bud and I talk about thermoregulation in walruses, then walk to the northwest point of the town. Huge seas are rolling southwest and the spray blots out the red sun that momentarily appears as it sets between the mountains of Siberia. There is no ice anywhere and Winnie is worried; the season may be about over.

Wednesday, May 17. Wind, high seas, dark clouds.

Aivok is now all we have, and he is very weak. He feels dry and warm but he needs more than this. Bud has talked me into something I wouldn't have tried in previous years, for fear the too rapid change in temperature would lead to pneumonia: I now have the baby walrus in my bedroom, crated and with a tarpaulin under the crate for easy cleaning. He has also had a large vitamin B complex shot and some oral antibiotics.

After a good meal and thorough cleaning, he went right to sleep. He snores.

Thursday, May 18. It was midnight when Aivok and I went to sleep, and I got up at 4 a.m. for a feeding. He has been sucking his "thumb" for some time and when I offered him a baby bottle he took two in rapid succession. End of the stomach tube period! We banned all morning visitors and let him sleep until 2:30 p.m. An hour later he took 2 quarts by bottle, spending only 15 to 20 seconds and 10 to 12 gulps per bottle. It appears we have another fast learner, like Ookie before him. At midnight he took another pint and went to sleep, snoring.

Friday, May 19. As I write this by candlelight at 1 a.m., it is a howling, snowing night. If it had not been for all the delays, we would be gone with our animals by now. Radio says Nome has soft south winds and the wind pattern indicates that the ice could be spiraled counterclockwise right around to the east side of St. Lawrence Island. If that has happened, it would be all over.

Again a hungry Aivok at 4 a.m. and after 54 ounces we both retire for a couple of hours. He is a good room-mate, improving in strength and he couldn't be better natured.

A morning of chores and Dick puts some crates together just in case the weather clears. The day is a bit better; no sun, but the wind has died down some. After Aivok's mid-afternoon meal, we do a bit of exploring on the old village sites, up to 2,500 years old, between the present village and Gambell Mountain. Piles of whale and walrus bones everywhere.

Aivok would not eat at the civilized hour of 9 p.m. After some talk of data with Bud, I retire at midnight, knowing it will not be for long.

Saturday, May 20. Here we are, up again at 4 a.m. with a much improved and very affectionate Aivok. During the day the wind shifts and the ice is coming toward us. There should be a hunt tomorrow morning. The situation is serious, for Aivok could eat all our food in another week. Moreover, Dick and Bud have to leave on May 24, at the latest, and without them this venture would not be possible.

By evening Aivok is remarkably improved. The 50-60-degree temperature of the house is apparently in the thermoneutral range we want, however high it may seem to be for an Arctic animal.

Sunday, May 21. The storm has ended and the hunt began at 1 a.m. The ice is 10 miles to the northwest and going north fast. No seals, but female walruses and their calves are plentiful. Winnie shot a cow and her calf never moved. As the skinboat struck the edge of the ice, I jumped for the baby, slipped into the water and got a good soaking. But I got the baby, which was undisturbed by the ruckus, and Bud and I struggled across the ice with it to the skinboat. It was a large and fat female, not more than a day or two old; later we found it weighed 162 pounds. I sheltered it from the wind while Winnie and Bud and the crew skinned and cut up the female. The skin will make Winnie a new cover for his boat.

The weather deteriorated rapidly and it was

Aivok went right to sleep after feeding in Dr. Ray's room, where for the first time he could be kept dry and warm — far warmer than he would have needed to be on the ice.

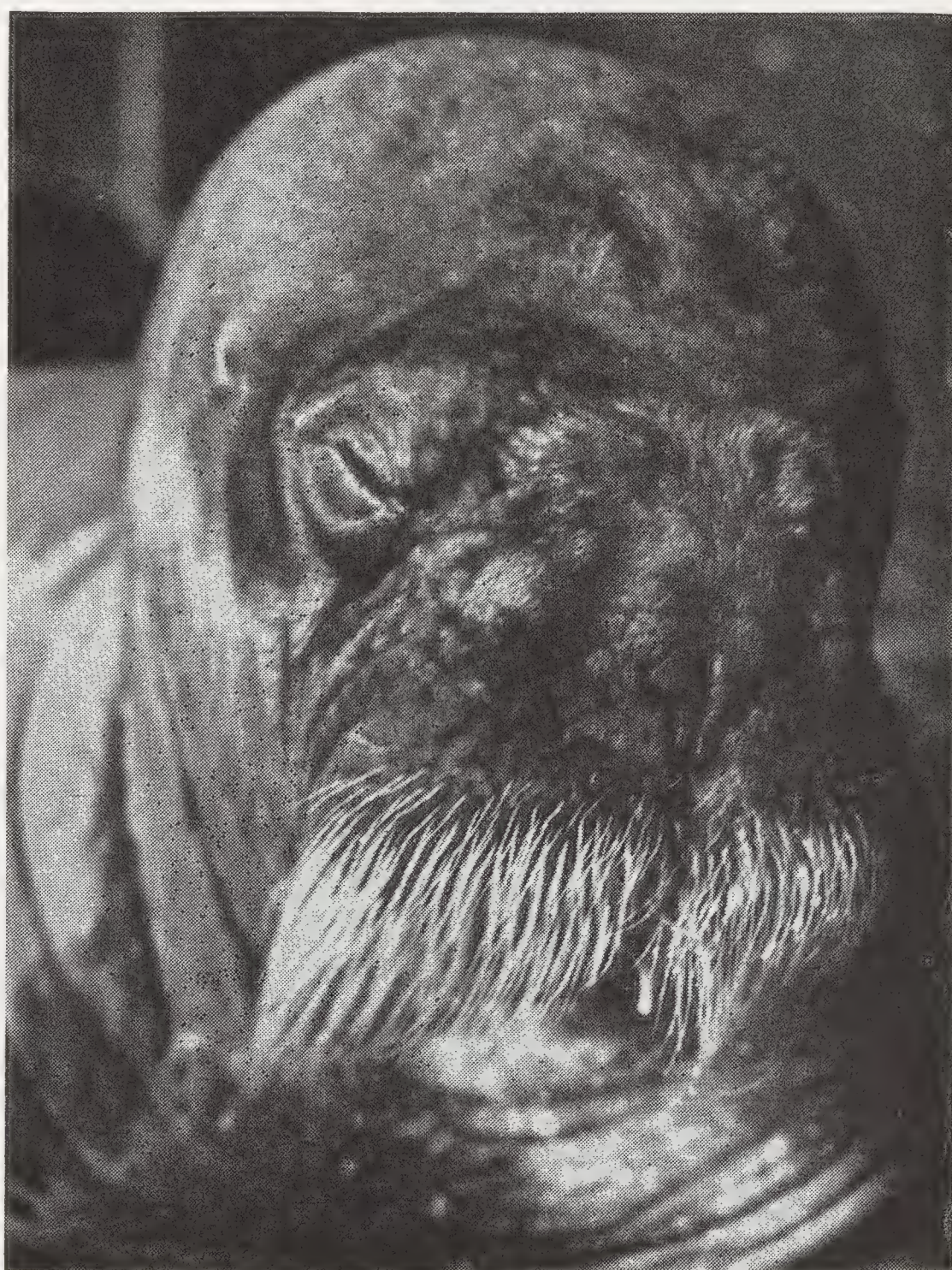
Photo by William B. Bacon, III, Fairbanks

a miserable trip back to the gravel beach. But the hunting had been good. Stephen Aningayou had a 159-lb. bull for us, which we named "Seeku," the Eskimo word for ice. Bud and I covered the babies with our bodies to protect them from the wind until a dog team could move them to the house. They were giving out a lot of heat, with skin temperatures of 54 to 93 degrees in the 28-degree air.

By 9 a.m. we found that the Kulukhons have another female for us; 130 lbs., named "Tipuk" for flirt. Mission completed: four walruses, three of them caught on a 6-hour hunt that saved the day. Three years ago we took out the first walrus that ever left this village alive and there was only one boat that would hunt for us, because of the belief that to bring a living walrus into the village would cause you to turn into a walrus yourself. Now several boats have been willing to help us.

As a bonus, Marvin Walunga has just come in with a fat, molting Ringed Seal. Just in time, for as I am writing at 6 p.m. the snow is drifting outside before a furious east wind.

Aivok has eaten all but 30 quarts of our walrus cream while we waited out the eight days of bad weather. This is a three days' supply at most.



The only sensible thing is to charter another plane to get out at the very first possible moment. Successful feeding at 11 p.m. and finally to bed — first time in a day and a half — to a loud chorus of walrus snores.

Monday, May 22. Up at 6 a.m. to feed the impatient four. Eight quarts of formula are doled out to nearly 600 pounds of walrus.

There is a soft wind, but fog through which our plane can't land. A Wien Airlines C-46 is due at the first break and we've offered the Village Council the use of the plane to bring in supplies of heating oil. We plan a light feeding early tomorrow morning, probably the babies' last before travel.

Whale and walrus bones littered the ground on the sites of ancient villages — some of them 2,500 years old — near Gambell, for Eskimos always sought food from the sea.

From motion picture by the author

Tuesday, May 23. At 1 a.m. we fed them, with the formula cut with water to give liquids but reduce solids. Four sleeping walruses are forty times noisier than one. At 5 a.m. I am awakened by wet breath and a moustache tickling my nose; Aivok has broken out of his crate and has come to say "good morning." He made a mess on the floor that it took half an hour to clean up, so I stayed up and went for a walk.

Back at 8 a.m. The large female that had cost me a soaking is dead. Bud's autopsy indicates congestive pneumonia, for which there was neither warning nor remedy.

At 3 p.m. we were still dispirited by the loss when the skies suddenly cleared. We notified the plane to come pick us up and began giving away the smelts meant for seals we never captured. By midnight I had said goodbye to Winnie and Dick and was out of Fairbanks on a Seattle-bound plane, now alone and on 24-hour walrus duty.





Wednesday, May 24. The babies slept well all night. We touched down at Seattle at 10 a.m. and it was a matter of waiting most of the day for the United freight flight to New York (19 hours and 7 stops). I recruited a freight attendant who was delighted to be a part-time walrus feeder and gave the babies their last good meal before arriving at the Aquarium. We left Seattle at 8 p.m.

Thursday, May 25. A freight flight is a wonderful way to travel with walruses. I have my sleeping bag right next to the crates and can sleep in snatches most of the night. All four animals were watered at stops, but they slept most of the time.

By 9 o'clock tonight we have all arrived safely at the Aquarium and the babies have been successfully fed. They have lost 7 to 14 pounds each, one of the penalties of commercial transportation and lengthy travel time. But no matter. They are home and well.

Postscript. After we left Gambell, the weather did a turnabout and became poor again. The

Returning from the successful hunt on May 21, Dr. Ray huddles over a baby walrus on the sea beach to protect it from the biting wind until a dogteam carried it to shelter.

From motion picture by the author

last hunt for female walruses this year was the 6-hour one on May 21. A few more seals were caught and one was shipped to us, to join the one brought back with the three walruses.

The walruses are gaining weight at the fastest rate yet recorded. All were trained to the bottle within 2 or 3 days after arrival. Aivok was 198 lbs. as of July 1 for a gain of 64 lbs., 48%, over his weight on arrival. This is 1.8 lbs. a day. Seeku was 200 lbs. for a gain of 55, or 38%, just 1.5 lbs. per day. Tipuk, the little female, weighed 156 pounds. This is a gain of 36 lbs., or 30%, nearly exactly 1 lb. per day.

If they continue to flourish, we will be well on the way to an exhibit of a herd of Atlantic and Pacific Walruses. And I think we can count on them to communicate some of the meaning and excitement of their home in the Arctic wilderness.

Those "Stately Land Fowl"

GOURAS OF NEW GUINEA

By DAVID FLEAY

West Burleigh Fauna Reserve, Queensland, Australia

FOR SIZE, BEAUTY AND GRACE there is no doubt that in all the world New Guinea's Gouras or Crowned Pigeons are pre-eminent in the Columbidae. Even as far back as 1700 the realistic explorer Dampier was sufficiently impressed to describe the species he saw as "a stately land fowl."

Not only spectacular in size but prideful in bearing and plumage, these elegant giants of the pigeon family are even larger and heavier than Scrub Turkeys, their aristocratic bearing enhanced by magnificent, permanently-erect head-dresses that even Peacocks might envy.

Known since 1776 as Goura Pigeons (*Goura* is also the generic name), these outsized ground-loving pigeons are strictly New Guinean, having evolved probably in the absence of any predatory animals of consequence. Nowadays they are said to have been greatly reduced in numbers owing to hunting by better-equipped native hunters. Years ago no less than eight species of Gouras were recorded but in the latest revision they have been reduced to three.

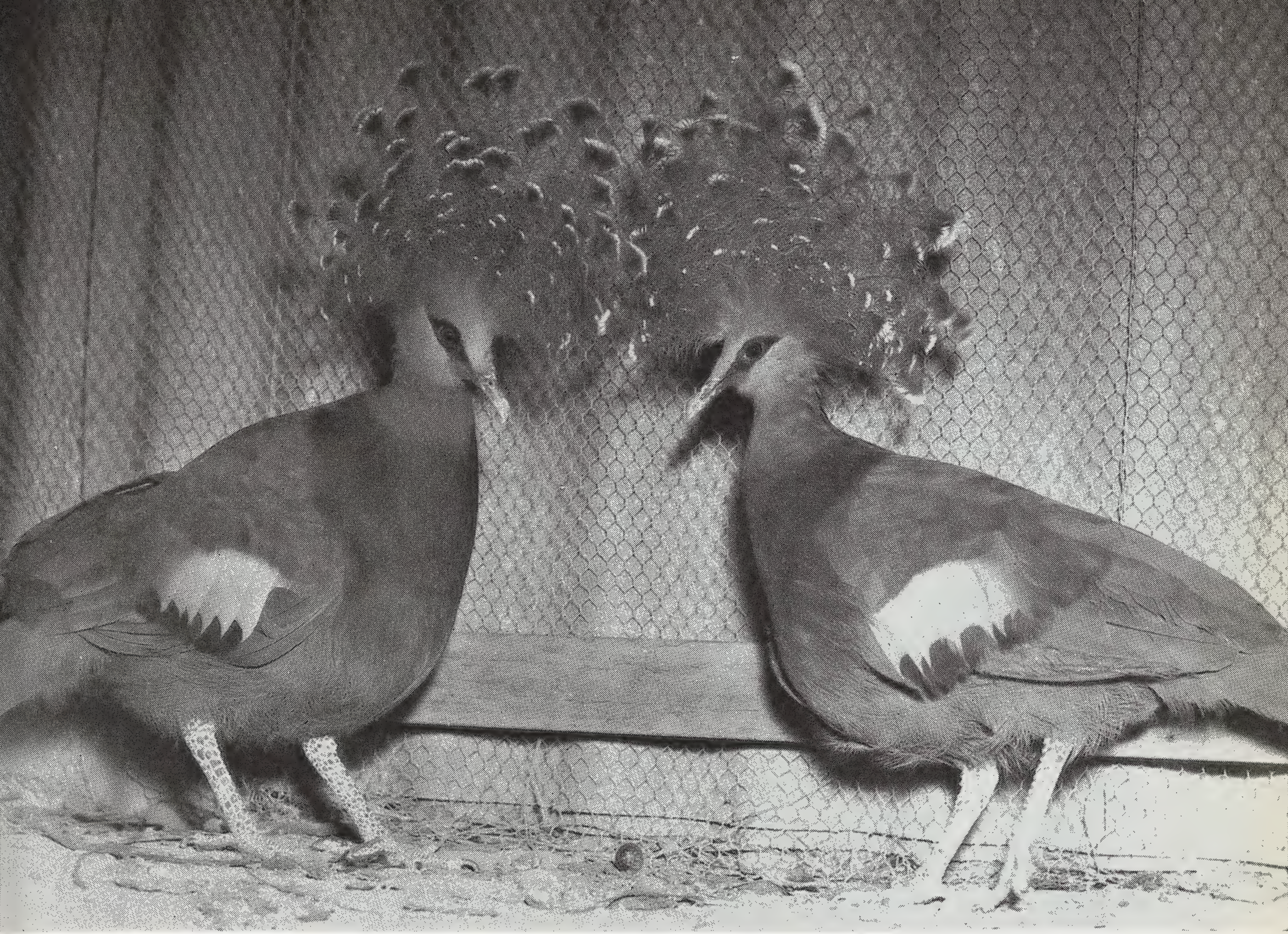
One of these, named early in her reign in honor of England's great Queen, is the Victoria Crowned Pigeon (*Goura victoria*). It has been determined as living on Japen Island in Geelvink Bay and (introduced?) to Biak with a closely similar form (*Goura victoria beccarii*) ranging along neighboring Northern New Guinea from the Siriwo River to Astrolabe Bay and Collingwood Bay between Holincote Bay and Mount Maneao. I had long nurtured an ambition to observe these lovely birds at close quarters and on August 5, 1959, the wish became pleasurable reality with the arrival by air of a pair of Victoria Crowned Gouras. As far as can be ascertained, they are of the subspecies *beccarii*, for their origi-

nal locality was the valley of the Jimmi River, about 110 miles inland. Their advent was the result of an exchange between Sir Edward Hallstrom of Taronga Zoological Park Trust and our West Burleigh Fauna Reserve in Queensland — one of a number of acts of sympathetic assistance from Sir Edward in recent years.

Clothed in eye-catching, blue-gray plumage, which contrasted with russet breasts, chestnut wing patches and ruby-red eyes, the new residents were sheer living beauty, particularly when sunlight shimmered on their eight-inch head plumes. A little girl summed them up when she exclaimed, "Mummy, look at those birds with flowers in their hair!"

Much thought and effort had gone into the preparation of a sheltered aviary among acacias on an elevated windless hillside. We knew that the big pigeons spend the greater part of their time on the ground, fossicking for berries, seeds and fruits, so we were delighted to see them quickly approving their quarters by walking hither and yon, wagging their tails rapidly in characteristic up-and-down movements and holding their fantastic crests at maximum elevation.

After a week or so of settling in, they often flew heavily to low boughs and we noticed that a whirlwind of dust was created. They were so big that the act of becoming airborne necessitated powerful stroking on take-off. About this time we began to hear the bigger male calling occasionally in prolonged, lugubrious "moos" for all the world like someone blowing strongly over the top of an empty milk bottle. The sound evidently struck a responsive chord in a "widowed" Eagle Owl (*Bubo bubo*) nearby and throughout the day she responded with loud "hoos," though strictly a bird of the night. The Crowned Pigeons



also uttered an alarm note, soft but penetrating, on the appearance of any strange animal such as a dog.

By the middle of August, 1959, the male Goura — distinguished from his somewhat retiring mate by more vivid ruby eyes — signified approval of the lowest of three wired-down platforms of sticks to the extent of sitting upon it and silently huffing his wings each time the female flew up to perch. Between times he fed daintily upon sliced fruit, lettuce, grapes, cracked corn, carrots, peanuts and the greatest favorite of all, ripe figs from a neighboring Moreton Bay tree (*Ficus macrophylla*). Victoria Crowned Gouras are extremely fastidious feeders. Rarely are any food items swallowed without being picked up, rolled about in the beak and dropped perhaps half a dozen times before final disposal. Strangely enough, peanuts holus bolus in the pod are usually preferred to the shelled product.

The courting activities of colorful birds seldom fail to provide spectacles of charm and grace. For

A child's description of Crowned Pigeons as "birds with flowers in their hair" is apt. This is a pair in Mr. Fleay's aviary. On the ground lies a Moreton Bay fig, a fruit that is a favorite of the pigeons.

All photos by the author

a whole month the male laid on the charm but never did a female seem to care less. He gathered thin twigs and flew them one at a time to the platform for careful arrangement, though at the rate of perhaps a single twig per hour. Then a true New Guinea "Sing Sing" atmosphere crept in, for while the birds were on the ground the cock Goura stepped briskly in circles about the hen. When she became motionless and her attention was fixed, he would sweep his spectacular head-dress to the very ground between his feet. Simultaneously he dropped his wings and elevated his tail, emphasizing his vigorous bows with booming calls of "Boom — Pa!, Boom — Pa!, Boom — Pa!"

At any intrusion on what was now his territory, the Goura put on a display of pugnacity,



The male Crowned Pigeon erects its crest to the highest in an exhibition of threat behavior toward the photographer. Beak of the 3-weeks-old chick is indicated by stick in mid-lower foreground. Parental care was so efficient that the egg and the subsequent chick were seen only two or three times during the entire period of the incubation.

elevating his wings on high and raising his glorious head plumes to their zenith. At the same time he rumbled threateningly, jumping sideways and buffeting with a powerful shoulder in true pigeon manner.

For a whole month the courting show continued. It could be precipitated, I found, by the sound of falling water when the water bowl was filled from a hose. At other times, between the methodical addition of long and pliable twigs to the nest, the cock huffed his wings and called in his penetrating "empty bottle" note. Mrs. Goura showed not the slightest sign of interest or appreciation, but on the morning of September 26 we found her squatting on the nest for the first time. She began brooding from the moment of arrival of the large white egg.

All the evidence indicates a single egg to a clutch, about the size of a domestic fowl egg.

The nest, incidentally, was three feet seven inches above the ground, in a sheltered corner under a roof. It was 22 inches across and four to five inches thick, composed of pliable twigs up to 20 inches in length.

The male immediately dropped all dramatics and within twenty-four hours took over the day shift on the egg, brooding sedately and soliloquizing in low, crooning booms. The hen's turn for the night usually began between 4 and 5 p.m. and so tight was the schedule, with never more than a momentary exposure of the white egg, that it was a whole week before we even caught a glimpse of it.

The daily change-over followed a definite ritual with the non-sitting bird flapping up to the nest carrying a selected twig. This was offered to the pigeon on duty with all the solemnity of a locomotive driver passing the staff to a station

master. The sitting Goura then, and only then, would tuck up its shanks and shuffle slowly off the egg to make way for the relief sitter. It was impossible to secure pictures of the change-over, for the hen would have spooked easily and in any case the cock Goura resented approaches of any kind.

Three weeks passed with no sign of a hatching nor was the cock ever seen to regurgitate food for his mate. Undoubtedly he did so, however, for occasionally on his approach she began working her beak.

Soon it was four weeks, and our luck was apparently out. But on the 30th day half an egg shell lay on the ground and we knew that the fledgling had arrived. We longed to see it but

the baby remained so tightly tucked beneath either parent that seven days elapsed before the grayish-downed infant was first glimpsed. So protective was the male that my attempts to take pictures were immediately greeted with wings raised on high, a gorgeous corona of crest, threatening rumbles and actual strikes. He was so big and so strong that following one wing-buffeting my right wrist was numb and painful. It was obviously wise to desist in case the typically soft pigeon fledgling was accidentally killed.

The fledgling male on the nest. At this stage (four weeks old) it left the nest and perched higher. Still short-tailed, it was a pigmy in size compared with its huge father and mother.



From this evidence I am sure it would go ill with any intruder, apart from man and pythons, attempting to interfere with nursery arrangements in Goura Pigeon land.

Our first sight of the baby was the merest glimpse when, at the age of one week, it was seen taking regurgitated food with only its head projecting from its father's protecting plumage. There was time only to notice that it possessed a small knob on the crown as the sprouting point for the future head-dress.

The parent birds continued to keep the growing infant out of sight, the cock becoming even more pugnacious about intrusions. Then, dramatically, at the age of four weeks when it was only as big as a homing pigeon and a mere quarter the bulk of either giant parent, the leggy, stub-tailed fledgling came into full view by deserting the nest abruptly and entirely. Well-feathered but bunchy-crowned, it flew high into the aviary and perched safely. Next day it walked about the ground between the parents, uttering short and plaintive whistles of entreaty while wagging its stubby tail up and down in the characteristic manner of the species. For several nights habit carried the mother back to squat overnight on the stained and flattened nest, but the male slept protectively beside his small offspring on the highest perch.

It was now late November and the moulting season had begun. As time went by and the active baby gradually increased in size, its crest developed also but for months it remained dependent entirely on regurgitated food delivered by both parents.

At twelve weeks or roughly three months, except for its juvenile squeaking it could have passed as an adult and had become equal in size to its mother. On account of its dazzling plumage and proud bearing we suspected it to be male, which eventually proved to be the case. It was an extraordinarily playful youngster, throwing up its wings, jumping sideways and running broadside at an imaginary foe with fine *joie de vivre*. Even in these days it still accepted pre-digested food from the old birds and had never been seen to pick up food for itself. Self-feeding was first observed on January 26, 1960, when the "baby" was a little more than thirteen weeks old. Thereafter it gradually developed an independent at-

titude, though accepting parental handouts whenever they were offered.

At five months the young Goura began to exhibit aggressive as well as playful behavior, often fetching either its father or mother a smart crack with a strong shoulder. The squeak was going out of its voice and though slim in the legs it promised to be the biggest and finest member of the whole family.

Mid-way through 1960 the father Goura died suddenly, as a result either of swallowing some substance dropped by visitors or because of some ailment we did not recognize. He became a treasured exhibit of the Queensland Museum.

As the year went on it became obvious that though some slight interest was taken in the old nesting site by the female, the young male was too immature to encourage her and no egg-laying occurred over the 1960 season.

However, on April 3 of this year the first courting display by the youngster drew our attention because of his loud calls of "Boom — Pa!, Boom — Pa!, Boom — Pa!" We ran to the aviary and found him in characteristic courting pose, with elevated tail and down-swept head-dress, bowing repeatedly to advertise his grandeur to the female before him.

It was definite evidence of his male sex and an indication that it took him 17 months to attain maturity. Nowadays his well-being is expressed in continual play-acting with wings on high, jumping from side to side, uttering "intimidating" rumbles or flapping both wings almost with a crack on landing, like some proud rooster about to crow.

I have come to expect displays or "combat dances" when I enter the aviary with food trays and the Goura needs only the excuse of a few of the birds known as Noisy Minors, or "Mickies," landing in trees above to start his acrobatics all over again.

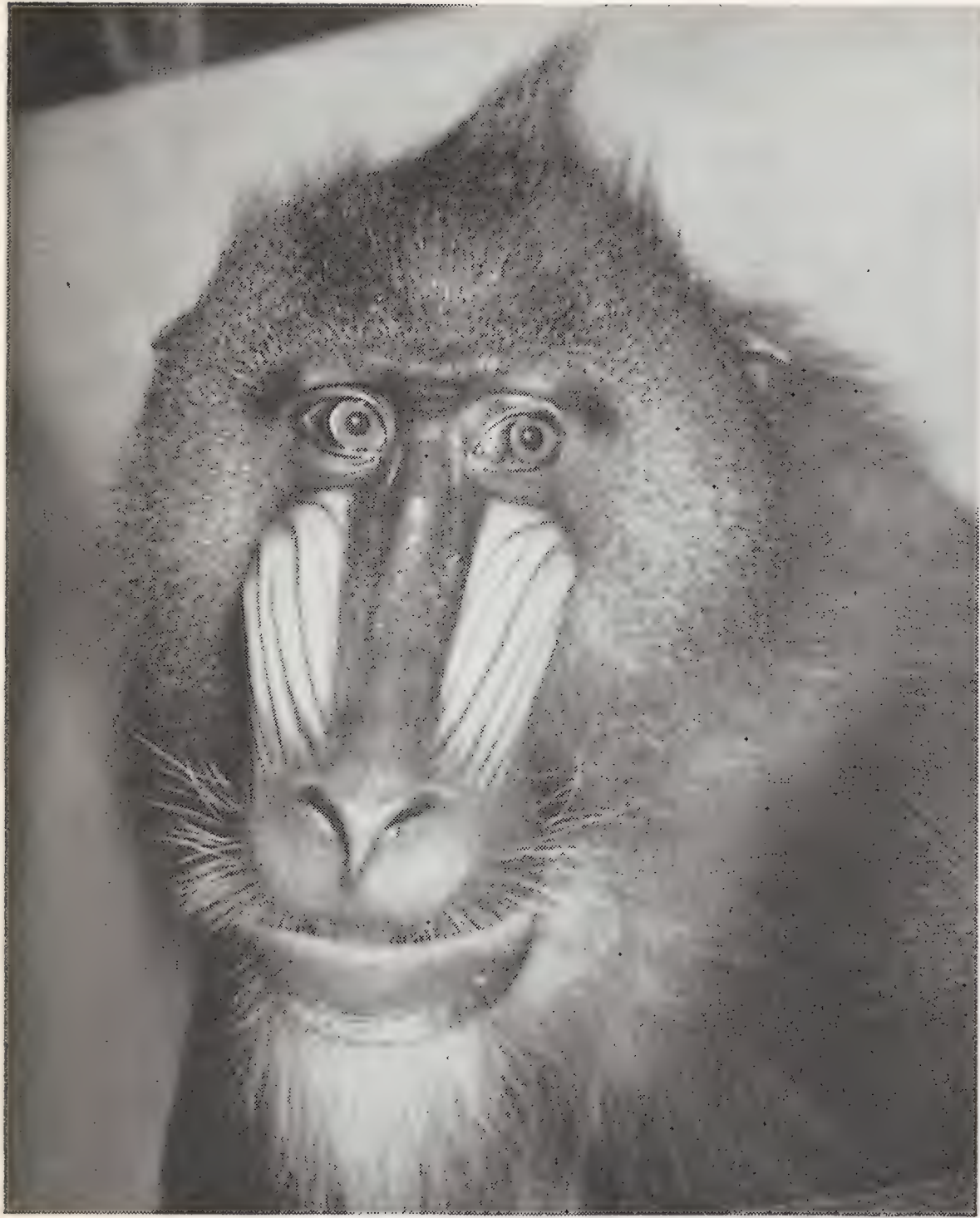
Often now, on warm, sunny mornings, far-carrying but lugubrious "moos" come from him and he is usually discovered perched at the nest edge and looking intently at what is left of the platform of sticks. We have renewed hope that after the partial moult now in progress (I am writing in late April of 1961), we will still be in a position to breed more of these magnificent Crowned Pigeons.

ZOO NEWS IN PICTURES

Photographs By SAM DUNTON



There may be prettier antelopes than the **GERENUK** — indeed, the Bongo is often called the most beautiful of all the nearly one hundred species and sub-species of antelopes in Africa — but none more delicate and graceful. We have exhibited Gerenuks a number of times, and the tall male in this photograph has been in the collection since the fall of 1957. Now we have added two young females, which came on June 28. Introduced gradually to the male, they settled down quickly and share a big corral. One female is timid, but the other is quite willing to make friends and readily approaches the keeper.



Directly above is the latest portrait of the male **MANDRILL** who adds so much liveliness — but not loveliness! — to the collection in the Monkey House. He has still a year or two to go before he attains the full facial coloration of a male Mandrill; eventually the center ridge of his muzzle will be bright red. At the right above, the female Mandrill grooms her offspring, a male born on August 5 of last year and still a playful baby.



A pair of **ARGENTINE LAPWINGS** has been in the bird collection for more than five years and this spring, for the first time, we hatched — and so far are rearing successfully — two chicks. Five eggs were laid, in two clutches, and two eggs are now in the incubator and should hatch soon. This is the characteristic plover of the great Argentine pampas, locally called "Tero-tero."

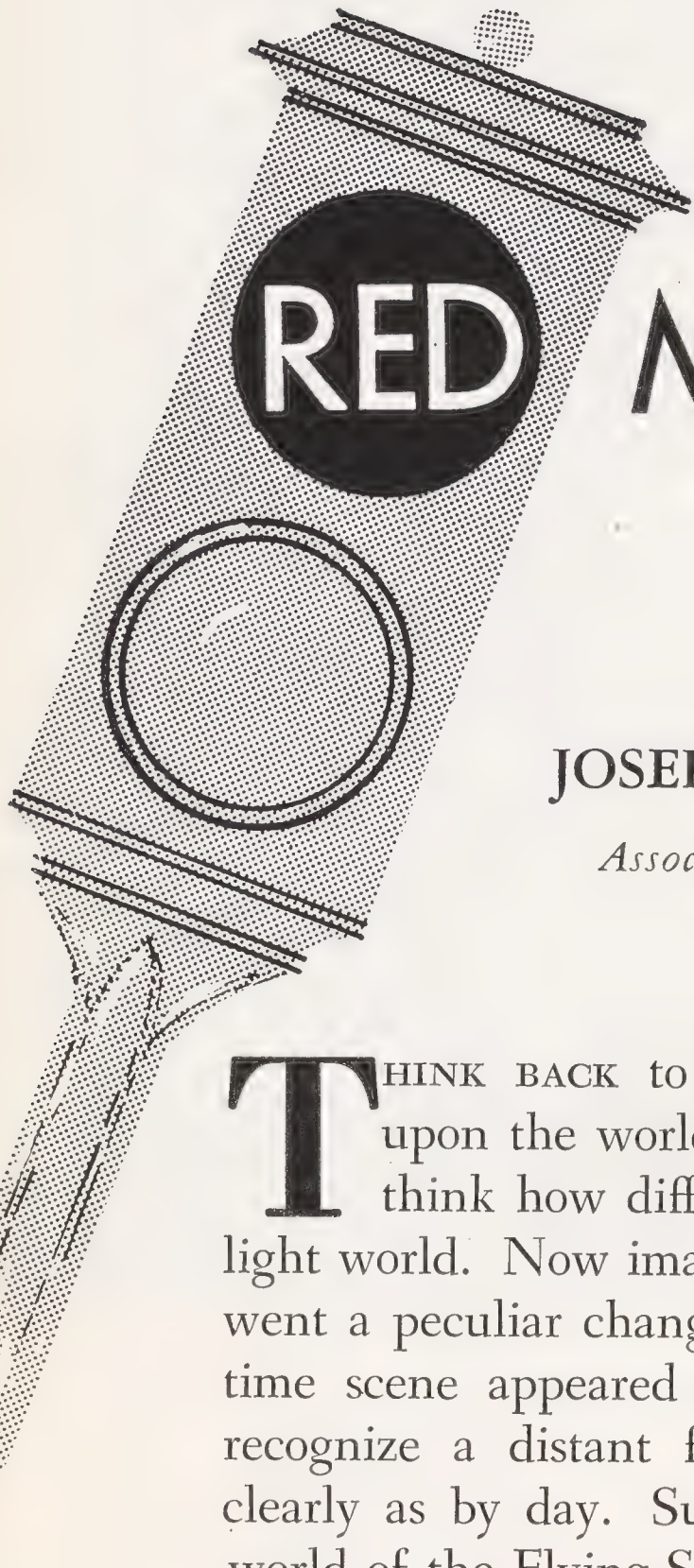
Peeking out from the protection of her mother's bulk is our latest baby **PIGMY HIPPOPOTAMUS**, born on May 13. She is entirely self-possessed, as indifferent to visitors as (most of the time) her mother is. This is the second baby born to our pair in the past two years.



A summer when our **LLAMA** herd can spare a baby for the Children's Zoo is always a red-letter year for children. This summer we have an especially beautiful Llama baby that has been named "Socks," from its white forelegs.

Our **BISON** herd is growing — slowly, but nevertheless growing. The newest bright-coated youngster, a female, was born July 9 and is thriving. A sturdy male was born in the spring of last year. Recently we have put up a special label on the Bison corral, telling the story of the founding of the American Bison Society in the Zoological Park in 1905. It was largely through the efforts of the Bison Society that the Bison was saved. Some nucleus herds on government preserves came from our collection.





RED MEANS GO!

By

JOSEPH A. DAVIS, JR.

Associate Curator of Mammals

THINK BACK to the last time you looked upon the world under a clear, starry sky; think how different it was from the daylight world. Now imagine that your eyes underwent a peculiar change so that this same nighttime scene appeared so bright that you could recognize a distant friend—or an enemy—as clearly as by day. Such a world as this is the world of the Flying Squirrel and the Skunk, the Galago and the Kinkajou. It is, in fact, the world in which about two-thirds of the three thousand or so species of mammals spend their waking hours. It is also the world of the owls, the Oilbird and the Whip-poor-will, and of many amphibians and reptiles. It is a world that has been barred to man since our species came into being, one through which we could only stumble until we fashioned our own light. From the beginning, man's firelight kept the creatures of the night at bay, and in modern times these same creatures continue to shun man-made light as they do the light of day. In zoos, small mammals (the majority of the nocturnal species) have found a satisfactory solution to life in an illuminated cage. They sleep during the hours of daylight (real and artificial) when they are on "exhibition," and carry on their active lives at night when no human eye is there to behold them save an occasional curious curator's. Satisfactory for the animals, if not for us.

The exhibition of living animals involves a three-way compromise. The public desires that

the animals be plainly visible. The operating personnel of a zoo require safe and reasonably convenient access to animal enclosures for feeding and cleaning. The animals themselves need living quarters that are not only sanitary, but psychologically suited to their mode of life. Fortunately for all concerned, most animals' needs are easily met and they can be kept under conditions that satisfy them, the public and the zoo people. Small mammals are the exception. By way of example, take the case of a Cuscus, a kinkajou-like marsupial from New Guinea.

Eight years ago, long before my association with the Zoological Park, I wanted very badly to get photographs of the external anatomy and posture of this species, and there was a specimen in the Small Mammal House. I spent most of a day stationed in front of the cage, but all I ever saw was an ill-defined patch of gray-brown fur stuffed into a hollow log—the sight that most visitors see. Had there been no log I might have had a better view of a ball of fur, but scarcely a hint of the animal's form. The log was there out of deference to the Cuscus's need for a refuge during daylight; it was part of the Zoo's compromise that favored the animal more than the public. I did get my photos, but only after I had received permission to return at eight o'clock the next morning and the keeper had coaxed the Cuscus from her den. Only because the log was removed and she was gently kept on the move during the photographic session was the animal forced to display her true form.

There are, of course, ways of making animals visible at night, in their active time. During the Second World War a device was invented which projects an invisible beam of infra-red light, and by means of electronics converts the invisible image from this beam into a visible image on a small, TV-like screen within a telescope. These

instruments, called "Snooperscopes" or "Sniperscopes," are of military value but they are also used today by zoologists who want to observe the actions of animals under "lightless" conditions. They are excellent for the purpose but very expensive, and ill suited for zoo exhibition since only one person can look at a time, and what he sees is not the animal, but a flat image.

Zoos have long been seeking a way to exhibit nocturnal animals, and several have at one time or another tried to reverse the daily activity cycles of small species. Animals, incidentally, have no trouble reversing their own cycles; a Slow Loris from South-east Asia, when it comes to New York, quickly adjusts to the twelve-hour difference in night and day, and becomes active during our night, precisely the time it would be sleeping in its native land. So far none of the zoo attempts have been totally successful. Some have dim blue light to simulate moonlight, a technique that has its drawbacks, chief of which is the dimness of the exhibit, and the consequent need to further darken the public space.

Sporadic and not noteworthy successful attempts at reversal had been made here in the past, the most recent employing blue light. But when, some months ago, we decided to do something about showing our nocturnal mammals properly, we abandoned the dim "moonlight" concept in favor of a very odd-looking red light, for reasons we will see shortly.

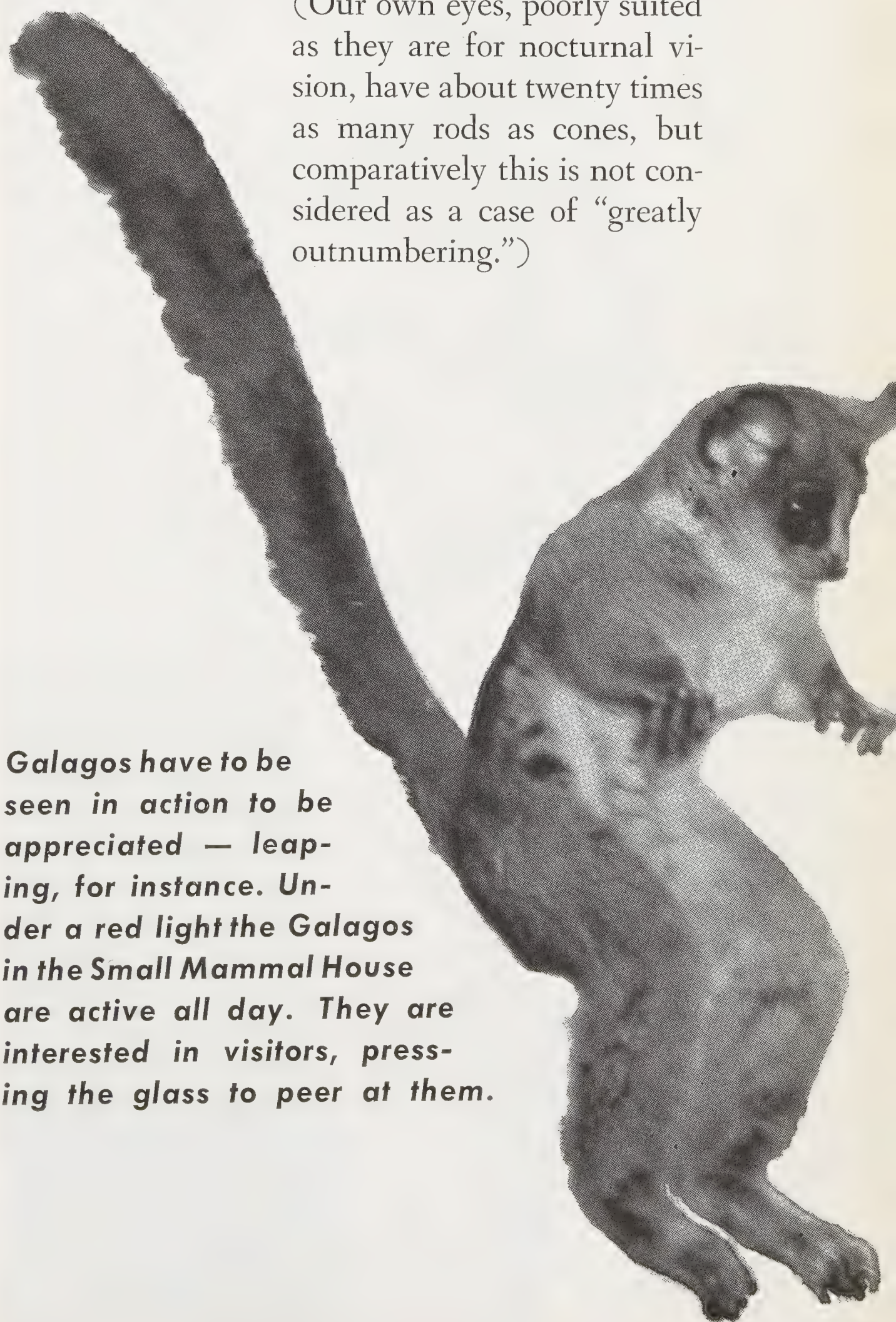
The key to the problem is rhodopsin, the light-sensitive pigment in the retina of the eye. The retina of man contains two types of cells involved in vision. The first, called cone cells because of their shape, are the cells which enable us to discriminate colors. These cones are excited only by relatively intense light. The second type of cells, the rods, are extremely sensitive to minute amounts of light, but do not respond to colors as such. Rods come into use at night, when light is too low to excite our cones. At night all cats are indeed gray, for we are color-blind under the evening sky. Rhodopsin is rapidly destroyed by light but builds up within the rods in darkness. This is why it is so difficult to find a seat in a movie house immediately after coming in from the street, and why, after we are comfortably settled, we can see so clearly the more desirable seats we missed.

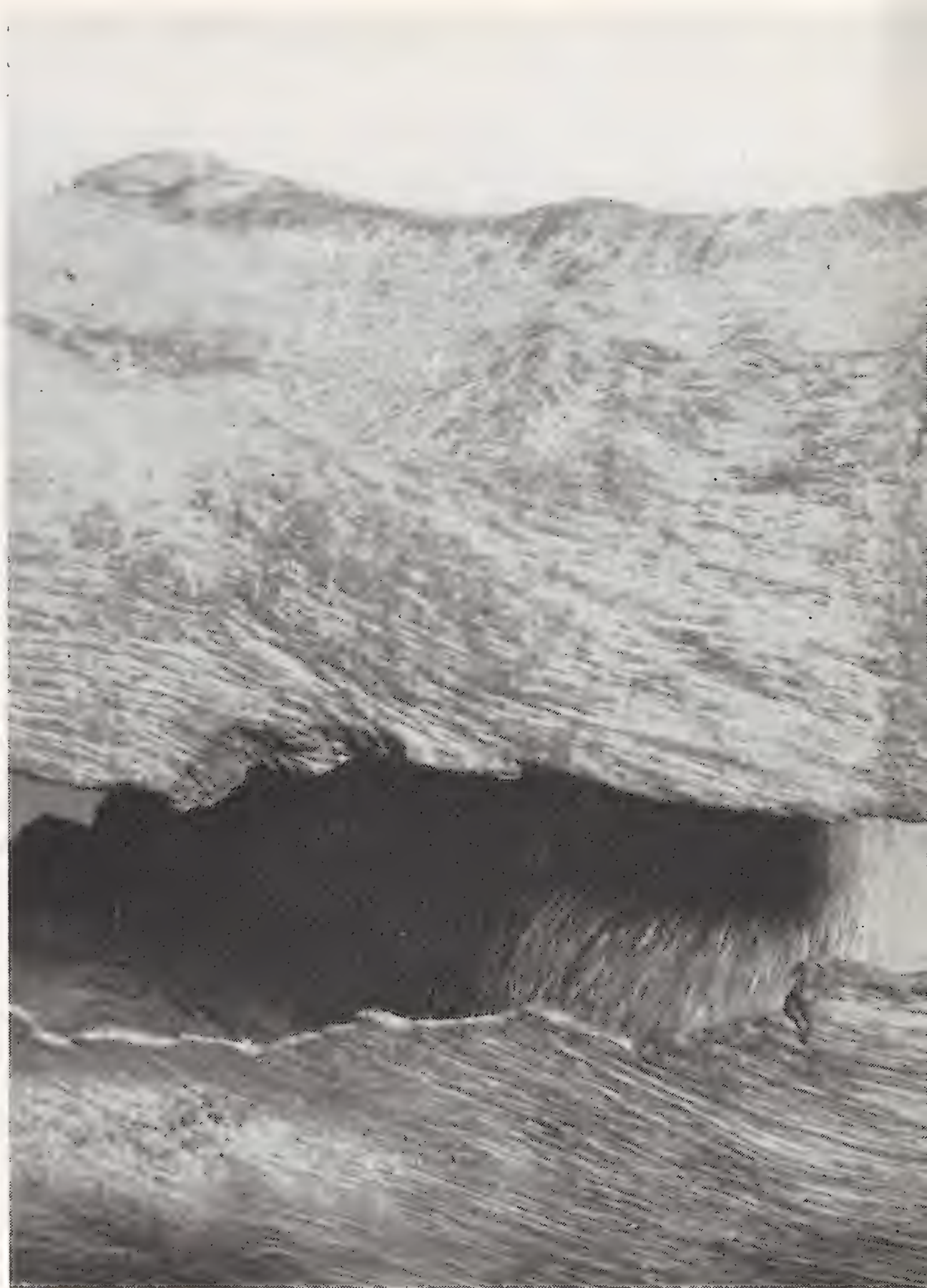
Our eyes are adapted primarily for diurnal vision, but we have enough rods to allow some nocturnal sight. Creatures of the night, however, have sacrificed color vision to pack as many rods as possible into the retina, and the sensitivity of their eyes at night far exceeds ours. So, under ordinary circumstances it is impossible to see one of these animals without letting him see you much more easily. Impossible, that is, unless you know the secret. The secret lies in the spectral sensitivity of rhodopsin. This substance, also called "visual purple," is deep red in color. Its color is due to the fact that, while it absorbs all other wavelengths, or colors, of visible light (and converts their energy into the sensation of light), it reflects red. Red is, then, an "invisible" form of light to an animal whose retina contains only rods.

A few species of mammals are known to have pure-rod retinas — the Douroucoulis, or Night Monkey, and some lemurs, for example. Others, including the cat, rat and dog, are known to have retinas whose rods greatly outnumber the cones.

(Our own eyes, poorly suited as they are for nocturnal vision, have about twenty times as many rods as cones, but comparatively this is not considered as a case of "greatly outnumbering.")

Galagos have to be seen in action to be appreciated — leaping, for instance. Under a red light the Galagos in the Small Mammal House are active all day. They are interested in visitors, pressing the glass to peer at them.



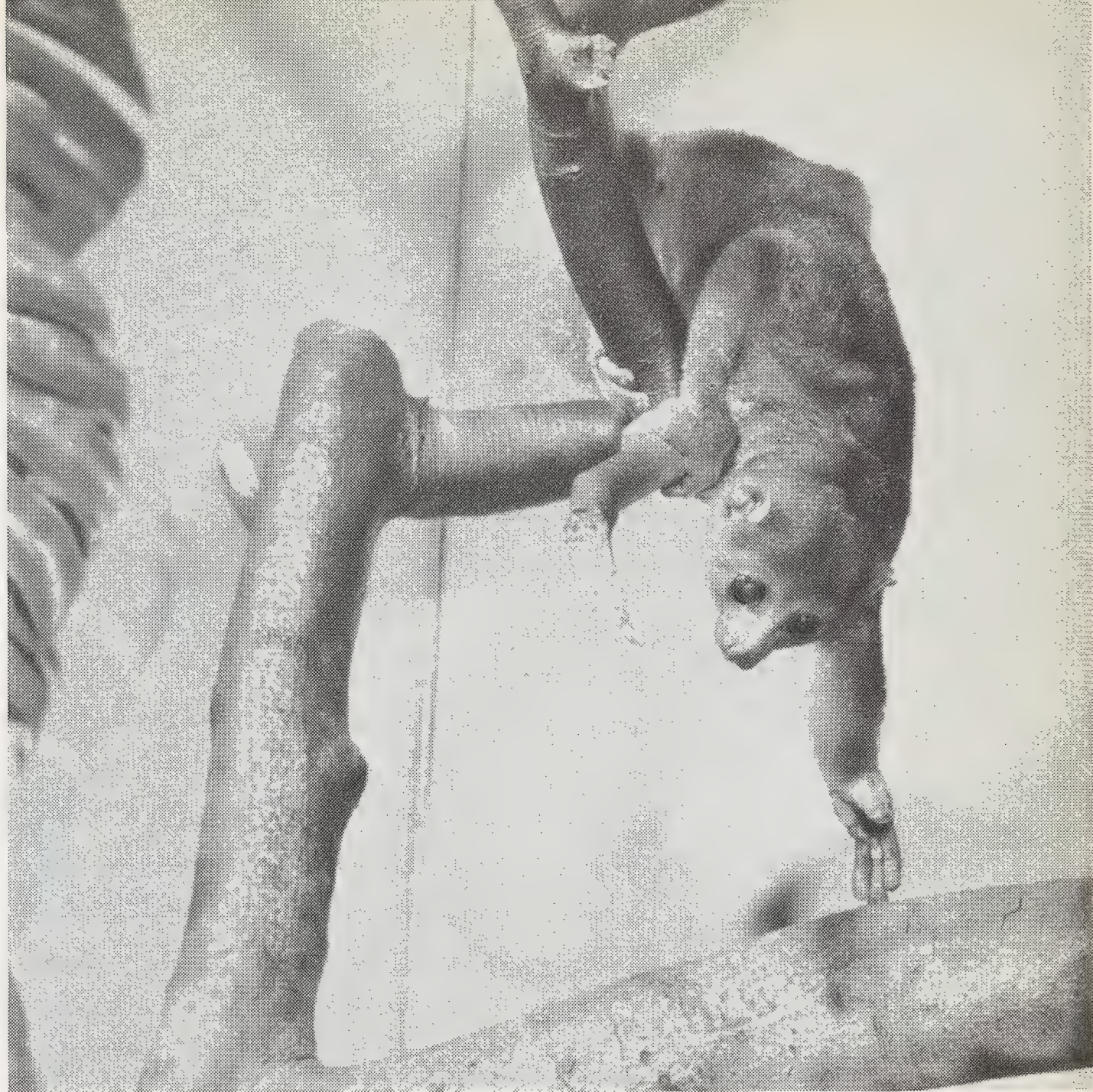


All of the photographs on this and the facing page were taken in the Small Mammal House between noon and 2 p.m. while red light was on. Above — The Solenodon yawned. At left — Flying Squirrels. Below — Palestine Spiny Mice.





Upper Right — Normally the African Potto is a sound sleeper during the daylight hours, but it adjusted to the new “night” hours and constantly prowls its compartment. Below — Long-eared Hedgehog, usually a mere curled-up ball.



It is said that a human eye, adapting to darkness from daylight, increases its sensitivity about ten-thousandfold. How much more sensitive the almost pure-rod eye of a nocturnal mammal is we can only guess. There is (or was until recently), no photometer sensitive enough to record the lowest level of illumination detectable by the eye of man, which as we have seen is itself not well suited for night vision. There are new electronic “light multipliers” that may now be better than our eyes, but we don’t know of one having been used to determine this sensitivity limit. Using mathematical calculation to take him past the useful limit of his photometer, Professor Lee R. Dice once concluded that an owl could see a dead white mouse on dark soil in the laboratory “very well” at less than one-millionth of a foot candle of light, and that the owl could see in light between one-tenth and one-hundredth the minimum intensity necessary for a man.

When we began to plan our own Zoo experiments in activity reversal we were not sure just what we would find. We were fairly certain that a dim-lighted “night” and a bright “day” would suffice to reverse at least some animals; that much had been done before. But would it be enough to reverse all species? How bright could we make our red light and still have “night”? How bright must the white “day” be? We are still experimenting, and to date the results have

exceeded our hopes. So far we have been successful with every mammal we have tried. A device designed and constructed for us by my brother, Pierre Davis, contains timing controls for a bright "day," a "night," and two "dusk" periods of dim white light. It includes heating controls as well, for a sharp temperature difference exists between day and night in deserts and a lesser but noticeable one in other habitats. We have not yet found any species that requires either dusk or temperature fluctuation to influence its activity pattern.

Our tests were carried out in the basement of the Lion House, in a darkened enclosure that surrounds the old Winter Platypusary. Atop the old Platypus tank we arranged a row of cages painted ruby red. Under red illumination the cage walls appear light in tone to us, providing a good backdrop for the animals. To the red-blind eyes of the animals the paint is very dark in tone, perhaps almost black, adding to their sensation of "night." Had we used a gray paint equal in tone (to our eyes) to the red, it would appear lighter to the animals, and any stray daylight leaking into the enclosure would further brighten the cage for them, for it would be reflected, not absorbed, by the pigment.

We began with a single cage, over which hung four 75-watt incandescent bulbs to provide the light of "day," and a single 7½-watt red bulb for "night." The red light was so dim that it allowed but a poor view of the two experimental Bushbabies in the cage, and the white lights gave off too much heat. Once the Bushbabies had reversed their cycle and we knew that our device worked (they required three and six days, respectively, to reverse) we substituted a 15-watt white fluorescent tube and two 25-watt red incandescents. The "night" was much brighter and "day" cooler now, but far from what we wanted. In the final arrangement, the one that provides minimum heat and adequately lighted "night," the red incandescents have been replaced by a single 15-watt red fluorescent tube, so bright that every hair of an animal is clearly visible — while the animal continues to move freely in its own private midnight world.

The effect of red illumination is a bit odd at first — we see everything in monochrome. Apart from the presence of red instead of a colorless

black-gray-white scene, we see the animals much as they see themselves, with one other odd but useful exception. Because most mammals are some shade of brown, which is made up of red, yellow and black pigment, any brown or reddish fur appears as a dark shade to the nocturnal eye, so that they seem darker at night than by day. Our red light produces the opposite impression for us — reddish or brown fur looks lighter than it does under white light, and the animals are that much more visible. As mentioned earlier, the same principle operates in our choice of color for the cage walls. Red walls increase the visibility of objects within the cage for us, while appearing comfortably dark for the occupant. In effect we have managed to utilize an environment that serves equally well the diametrically opposed requirements of the observer and the observed — a pretty neat trick, we think. This is not to say that when you visit the Small Mammal House you will see every animal bustling with activity now, for all animals, even the liveliest, cat-nap frequently throughout their active period. But your chances of seeing an alert, moving creature in each enclosure are immeasurably greater than before.

The early results of these tests were so encouraging that we set about to install control equipment in roughly two-thirds of the exhibition cages in the Small Mammal House, a figure determined by the floor plan, but appropriate enough, since it approximates the natural proportion of nocturnal and diurnal species. The only change from the experimental arrangement is the substitution of larger fluorescents to cover the larger cages. During the modification of the Small Mammal House we have continued to subject other species to the experiments, and have compiled an impressive list of successes that includes members of 16 families of five orders, a good cross-section of the mammals. More exciting, we are able now to form definite plans for a new type of exhibit building, the World of Darkness, a project that had been so far only a theoretical goal. In mid-September the Small Mammal House will be reopened and visitors to the New York Zoological Park will enter for the first time a world of active small mammals, no longer the private realm of Cuscuses, Cacomistles and Curators.

Their Day Begins at Sundown

REPTILES AFTER DARK

By HERNDON G. DOWLING

Curator of Reptiles

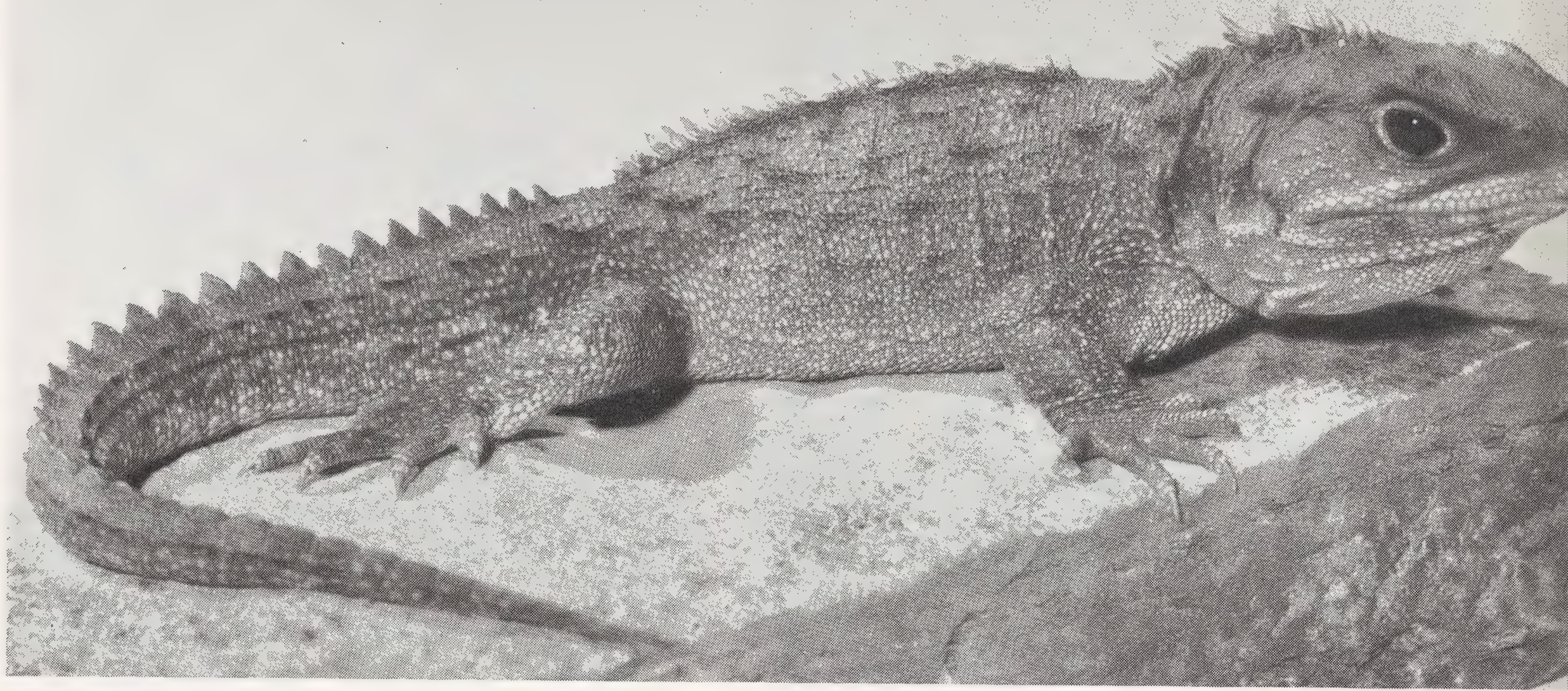


TO A PERSON who is only casually interested in reptiles it comes as a real surprise to discover that many, perhaps most, of these animals are nocturnal. This is better understood by the experienced herpetologist or by the professional reptile collector who often divides his hunting time equally between night and day — or perhaps unequally in favor of night collecting. This widespread but relatively unknown habit of night activity among reptiles accounts at least in part for one of the most frequently asked questions about the inhabitants of a reptile house: “Is it alive?”

Actually more than half of the reptiles in a collection are normally active at night and would prefer to spend the day tucked into some secluded corner for a nap. Many of them — rattlesnakes and crocodiles are examples — change their habits under captive conditions and become fully active during the day. Such shifts are usually made in response to daytime feeding schedules and young animals especially are found to be awake and actively waiting for the food to arrive. Other reptiles are more resistant to change and some of the snakes, such as the Asian Mangrove Snake, must be shaken awake in order to be fed during the day.

What characteristics do we look for in nocturnal animals? Vertically elliptical pupils of the eyes — “cat-eyes” — is one, of course. This type of pupil, closed to a slit in the day, can expand into a huge round opening in dim light. Among reptiles this kind of eye is found in the Tuatara, in geckos (the only predominantly nocturnal

Top — The pupil of the Tokay Gecko's eye is a mere slit in bright light. Middle — In dimmer light the pupil begins to open. Bottom — Fully open in darkness. White spot is light source.



Among the Tuatara's peculiarities is activity at temperatures at which other reptiles would be stiff and immovable. Its eye has the vertical pupil which is typical of nocturnal reptiles.

lizards), in several families of snakes and in crocodilians. Another feature of nocturnal animals is that ordinarily some sensory structure other than the eye has been especially modified for use in a world of darkness. Most nocturnal mammals tend toward improved noses, longer whiskers and better ears. Some animals such as bats and oil-birds have evolved a sonar system. Nocturnal reptiles have not followed these same paths but some of the results are just as interesting.

One feature of nocturnal life that warm-blooded animals are relatively unconcerned with is, however, of prime importance to reptiles. This feature is the temperature of the environment. Since reptiles receive most of their body heat from their surroundings, they must be particularly careful of what that temperature is. Thus, in nocturnal reptiles we find that (1) either the reptile is active for only a short time after sundown or (2) it lives where the night temperatures are warm or (3) it is adapted to relatively low temperatures.

The Tuatara (*Sphenodon punctatus*), the sole remaining member of the otherwise extinct Order Rhynchocephalia, has carried adaptation to low temperatures to the ultimate among living rep-

tiles. Found only on some of the cool, foggy islets off New Zealand and active mainly at night, these strange creatures carry on normal activity at temperatures as low as 52° F. — temperatures at which most reptiles would be stiff and immovable.

We have had a Tuatara in the Reptile House for more than five years now. It has lived in a small refrigerated enclosure where the temperatures range between 65° and 74° and appears to be in the best of health, having set a record for Tuatara longevity in American zoological parks. Its normal nocturnal nature is not obvious since it is always active and alert in the morning at feeding time. However, if we miss this period we might as well forget it for the rest of the day. By noon the Tuatara is snoozing too soundly to be disturbed.

The turtles (order Testudines) seem to be the only reptilian group without any specialized nocturnal members. Most of them, in fact, are highly specifically diurnal — active during the day. Our common Box Turtle (*Terrapene carolina*), for example, prepares for the oncoming night by burrowing into a deep pile of leaves or even into soft dirt if a leaf-pile is not readily available. The sliders and other pond turtles sleep at night too but usually remain in the water, drifting up to the surface to take an occasional breath of air. Even the great Galapagos Tortoises do their grazing in the daytime and find some secluded spot in the brush or rocks to spend the night.

Sea turtles apparently have most of their activity during the day, though usually the females wait until after dark to come to the beach to lay their eggs. Whether this is their normal preference is questionable, however. Perhaps they have only recently been driven to it by the predatory men and dogs that haunt these beaches during the laying season. Or it may be that some of the sea turtles are normally night-layers while others lay during the day. In any case a whole herd of Ridley's Turtles (*Lepidochelys olivacea*) was photographed recently calmly laying eggs on an isolated beach in northeastern Mexico — in broad daylight.

However, at least the mud and musk turtles of North America (*Kinosternon* and *Sternotherus*) appear to be primarily nocturnal. They do little sunning, as indicated by the thick coat of algae that often covers their shells, and I have often found them frog-hunting (along with me) in the middle of the darkest nights. The common Snapper (*Chelydra serpentina*), too, does a considerable amount of overland travelling at night. None of these turtles has any obvious specialization to aid in these nocturnal ventures but they may rely

Caimans are often seen in the open during the daytime, but they are really active only after dark. This young Caiman's eye shows the slit-like pupil possessed by all the crocodilians.

greatly on their nose — or perhaps keen ears? We know too little about either their habits or their structure to be able to say.

With crocodilians the situation is completely reversed. The large eyes with elliptical pupils are possessed by all of the members of this group, whether they be alligators, crocodiles or gavials, and definitely show their specialized nocturnal status. Certainly plenty of people have seen alligators sunning on the bank in the Everglades or Okefinokee, or at least pictures of crocodiles sunning (or being shot) along the Amazon or the Nile. They are only half-awake then. It is at night that they really become alive. It is then that they do their hunting — whether for fish or fowl — or perhaps for a mate. The southern swamps vibrate to their love-bellows on spring nights, and after dark a spotlight on the placid roadside ditches of Florida highways reveals the ruby reflection from the eyes of many a small 'gator that has emerged from its daytime lair.

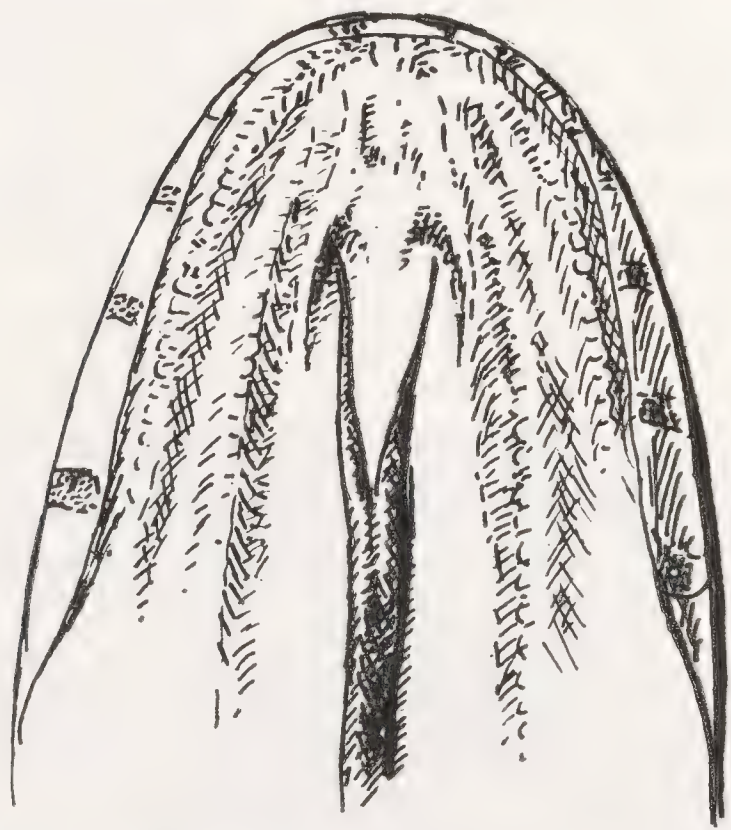
Lizards are mostly diurnal but the large vertically-elliptical pupils of one family, the geckos, show the night orientation of this group. There are a few day-active members among geckos but most venture forth at dusk, rapidly scampering across walls and ceilings throughout the tropics, to the dismay of the human inhabitants who often (erroneously) believe them to be deadly venomous. Correlated with this nocturnal habit,



geckos have a voice, a cheep, chirp, or whistle that has earned them their common names, from the Chak-chak of Trinidad to the Tokay of India.

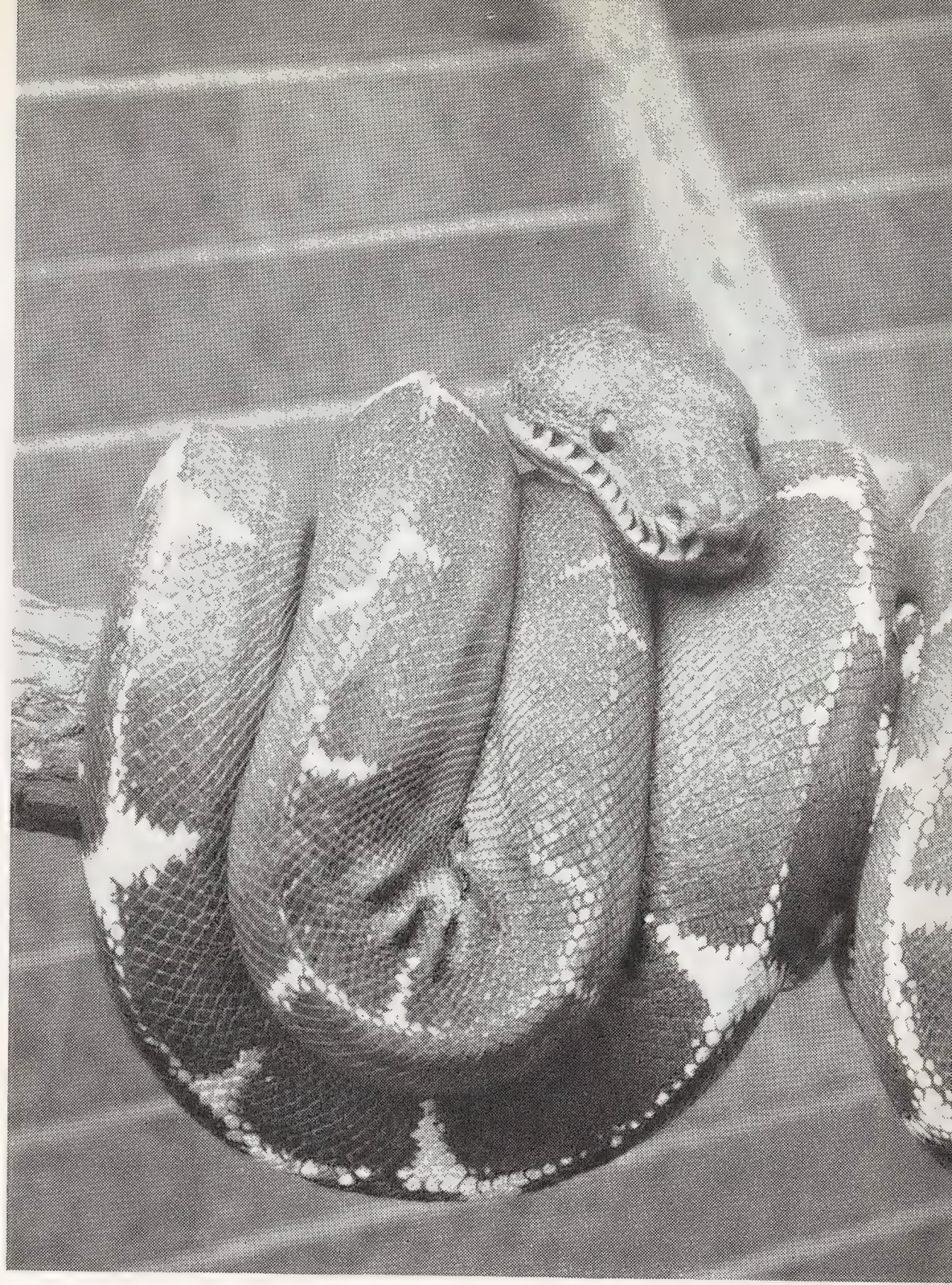
Snakes are so fashioned that they cannot use their ears or voices in night communication. The ear of a snake is much reduced; it has no ear drum and thus cannot pick up vibrations through the air. While this basic structural deficiency has undoubtedly restricted their specialization in this direction, snakes, nevertheless, have ventured into the nocturnal world in considerable numbers.

If we open the mouth of a snake and look at the palate in the roof of the mouth, we see one of the reasons why snakes have been able to take up a nocturnal existence. A pair of pits found here contain highly sensitive cells similar to those in the nose that sense the chemical particles that we recognize as odors. These pits contain what is called the "Organs of Jacobson." Rather than obtaining the scent particles directly from the air, as the nose does, these pits obtain them from the tips of the forked tongue. The rapid movement of the tongue is one of the most characteristic of



In this sketch the tips of a snake's tongue are shown inserted in the pits called "Organs of Jacobson" in the roof of the mouth. Scent particles from the tongue are analyzed in them.

serpentine actions. Its function is to flick out and pick up particles from the ground or from the air on the tips, which are then thrust into the Jacobson's organs for analysis. With such an organ-system a snake can follow the trail of another snake, or a food item, be it daytime or night, and



Nearly every scale around the mouth of some specialized tree boas has a forward-pointing "labial pit" that serves as a heat receptor — a sensory apparatus quite noticeable in this Emerald Tree Boa.

it has allowed snakes that are not otherwise obviously modified, such as rat snakes, king snakes and even ring-necks, to assume a nocturnal existence when the conditions warrant. Many such snakes become seasonally nocturnal when the daytime temperatures are too high.

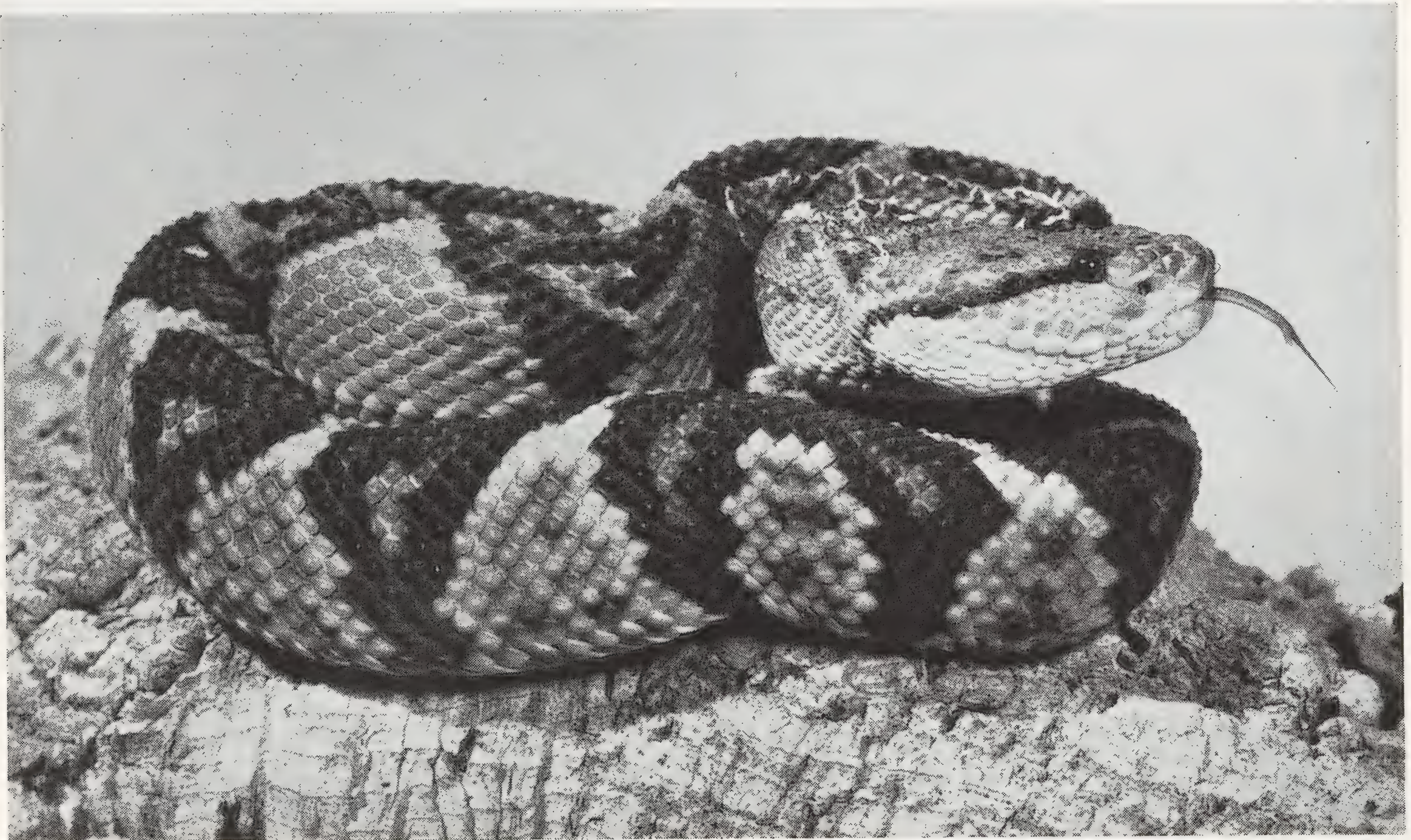
However, many snakes also have the vertically elliptical pupils that are the indicators of nocturnal specialization. The night snakes (*Hypsiglena*), lyre snakes (*Trimorphodon*), and cat-eyed snakes (*Leptodeira*) of our Southwest are common examples that belong to the great family Colubridae. Two other entire (though smaller) families are specialized for night life. These are the Boidae (pythons and boas) and the Viperidae (vipers).

Some members of both of these families, in addition to the characteristic eye, have evolved a completely new sensory apparatus that appears to be unknown in other animals. This is the heat-receptor pit system. Labial pits are found in most boas and pythons but are especially characteristic

of some of the specialized nocturnal tree-boas, where nearly every scale around the mouth has a forward-pointing pit. Among the vipers the group known as pit vipers (subfamily Crotalinae) has a facial pit as the characteristic feature. The function of this pit as a heat receptor was first demonstrated in 1937 by G. K. Noble and A. Schmidt.

The usefulness of a heat-sensitive structure that can give information on the direction and distance of a prey animal in total darkness can be

of animals that inhabit the same bit of swamp or jungle. In any case we do find that the tropical reptiles tend to have much more highly specialized requirements and this is seen particularly in the nocturnal snakes. Some of these snakes, although living in the tropics, probably seldom if ever endure a temperature as high as 70° F. and certainly cannot live if exposed for any extended period to temperatures that are higher than 80°. This is in contrast to many diurnal forms that



appreciated. When combined with the long fangs and powerful venom of the vipers, a very efficient food-capturing device indeed has been evolved. Most of the better known venomous snakes of this country are so endowed, including the Copperheads, Cottonmouths and rattlesnakes.

Even such highly adapted animals must make some adjustments to the varying temperatures of temperate climates. At the latitude of New York the Copperheads and Timber Rattlers, particularly the pregnant females, must spend considerable time sunning just to bring their body temperatures up to the active range.

In the tropics, reptiles can be more selective about their conditions—or perhaps they are driven to the narrow range of their habitats by the immense pressure of hundreds of other kinds

The Bushmaster of tropical America is one of the so-called pit vipers with a facial pit in front of the eye. Directed forward, it detects heat given off by the bodies of other animals.

commonly have active-range temperatures in the upper 80's and far different from some of the highly specialized diurnal lizards that require temperatures of 105° or more.

Thus, a rather large proportion of reptiles is adapted for activity after dark. In the temperate zone some of these have been forced to change their habits due to the low night temperatures but in the tropics many such reptiles hold to their narrow requirements, being allowed to do so by the extremely narrow seasonal variations that occur.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Dr. William Beebe Reports on Happenings at Simla

Several times a year Dr. William Beebe sends to the Trustees and Staff of the Zoological Society an Expedition Report from "Simla," our Department of Tropical Research field station in Trinidad. The reports summarize current activities and problems of the research staff and usually contain a number of "asides" by Dr. Beebe. Here are two sections from the most recent report on happenings during the sixty-second expedition of the Department:

Dr. Michael Emsley, who is Lecturer in Entomology and Zoology at the Imperial College of Tropical Agriculture, is studying at Simla a group of the world's record smallest insects. "Record" does not necessarily mean the largest pair of antlers or the longest serpent.

I once sent a cable to a famous Big Game Fisherman saying that I had caught the world's record Sailfish. He answered, requesting the exact length in feet and inches. I won his everlasting resentment by cabling the reply "Two and three-quarters inches," yet mine was as truly a record and much more valuable scientifically than a Sailfish of the largest size.

Dr. Emsley's insects are true bugs, possibly belonging to the family Anthocoridae. The only common name given to the family is minute Pirate Bugs, relatives of the Squash and Stink Bugs and of Water Striders. The chief character of Pirate Bugs is their small size. A nymph measures about one one-hundredth of an inch, comparing astonishingly with a Giant Water Bug which is four hundred times as large.

The general group to which our insects are related is represented by less than 120 species throughout the world, of which only three have been recorded from Trinidad. Dr. Emsley has taken 25 distinct forms of Pirate Bugs in a few days' collecting within 50 yards of Simla. Twelve of these are new to science.

The only thing we know about the sex life of these insects is the occasional presence of a single, relatively large egg visible through the skin of a female. We must presume a succession of similar eggs, to avoid the certainty of speedy extinction of the species.

They live in damp forest litter and are strongly attracted to light at night. Judging by the variation in the length of the rostrum, some are carnivorous and others vegetarians. A few of the females are wingless and resemble small beetles.

Here we have a glimpse into a Kingdom of Small whose inhabitants are as perfectly constructed as any butterfly or bird, and which live and feed, fly, mate and lay eggs, although they are only as large as half the diameter of a typed period.

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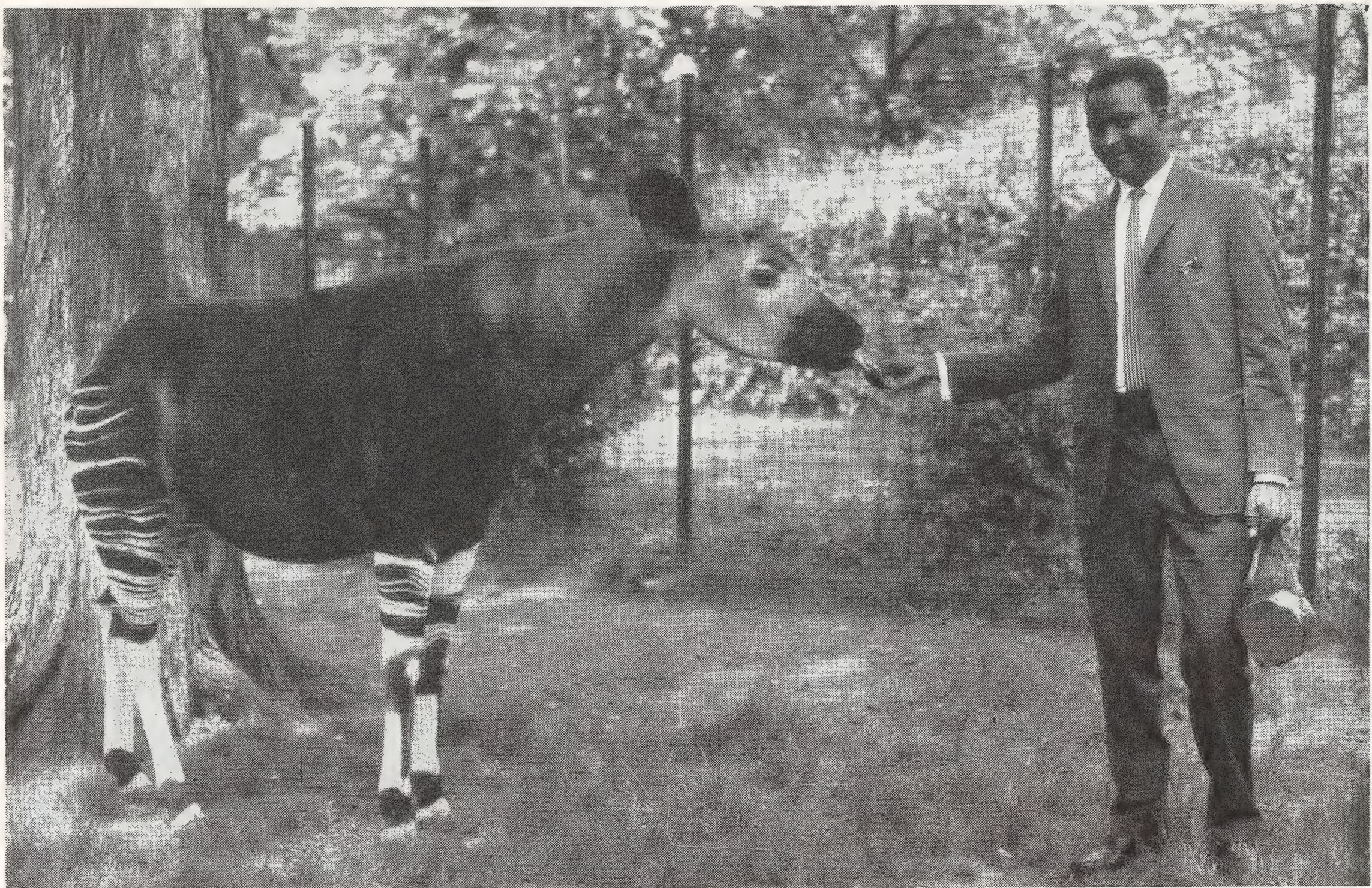
The problem of individuality in animals is illustrated by the fact that seventy-two years ago when I was twelve years of age, I began keeping a journal, and on a day in August, 1889, I find the entry, "Today, I saw two Monarch Butterflies, *Danais archippus*, flying south." This apparently revolting parade of a technical name, emanating from a precocious entomological infant prodigy, as a matter of fact reflected only that my mother knew Latin and Greek fluently, and imparted the interest of a smattering of these dead languages.

Today, on a walk in the mountains near Simla, I might have written "Today I saw six *Danaus plexippus* going to roost."

This sentence has three points of interest.

First is the uncertainty of steps in the evolution of human taxonomic nomenclature. Since the time of Fabricius 157 years ago, the Monarch has been embellished with the following names: *Papilio archippus*, *Danais archippus*, *Danais plexippus*, *Plexippus archippus* and *Danaus plexippus*.

A second fact of note is the comparison of this century and a half of man's intellectual percep-



Marcel Bahizi, who is in charge of the great Albert Park in the Congo, is currently in the United States studying the American parks system. On June 29 he spent a day in the Zoological Park where he saw many animals from the Congo, among them three Okapis.

tion of the insect with the time of evolution of the Monarch itself.

Another interesting comparison is that between our northern Monarch and the Trinidad subspecies with regard to habits. The northern form is noted for its migration, whereas the Trinidad insect is prone to roost in company but does not migrate.

Bright and Queer — New Fish Arrive from Bermuda

Bright-colored and queer-shaped tropical marine fishes for the Aquarium arrived in New York aboard the Q.T.E.V. *Queen of Bermuda* on July 21. In addition to the 144 fishes representing 26 species, there were five kinds of invertebrates and two unusual types of marine plants. Dr. Carleton Ray was responsible for transporting the specimens and he also helped collect some of them during a nine-day stay in Bermuda. Many of the fishes were captured by a Trustee of the

Society, Dr. Henry Clay Frick, and his family. The largest fish, a seven-foot Green Moray, was the gift of Director Louis Mowbray of the Bermuda Government Aquarium. This is one of several successful collecting trips to Bermuda that the New York Aquarium has made, and on each occasion Dr. Frick and Mr. Mowbray have contributed invaluable assistance in obtaining and shipping the specimens. — J. W. A.

IN BRIEF

Flamingo Article. An article by Director William G. Conway on his expedition to the Bolivian Andes to capture James's and Andean Flamingos was published in the July issue of the *National Geographic Magazine*. It was illustrated by many color pictures of the expedition.

Conference to Honor Gordon. The Fifth International Pigment Cell Conference to be spon-

sored by the New York Academy of Sciences in mid-October will consist of a symposium dedicated to Dr. Myron Gordon, the Aquarium's Geneticist from 1947 until his death in 1959. A prize in Dr. Gordon's honor will be awarded for the best paper.

Animal Curiosity. The responses of a variety of animals, particularly small mammals and reptiles, to novel objects are being studied in the Zoological Park this summer by Dr. Stephen E. Glickman and Dr. Elizabeth Van Laer of the Department of Psychology of Northwestern University. The study aims at an understanding of the evolution of curiosity in animals, from reptiles to primates, and is being conducted under a grant from the National Science Foundation.

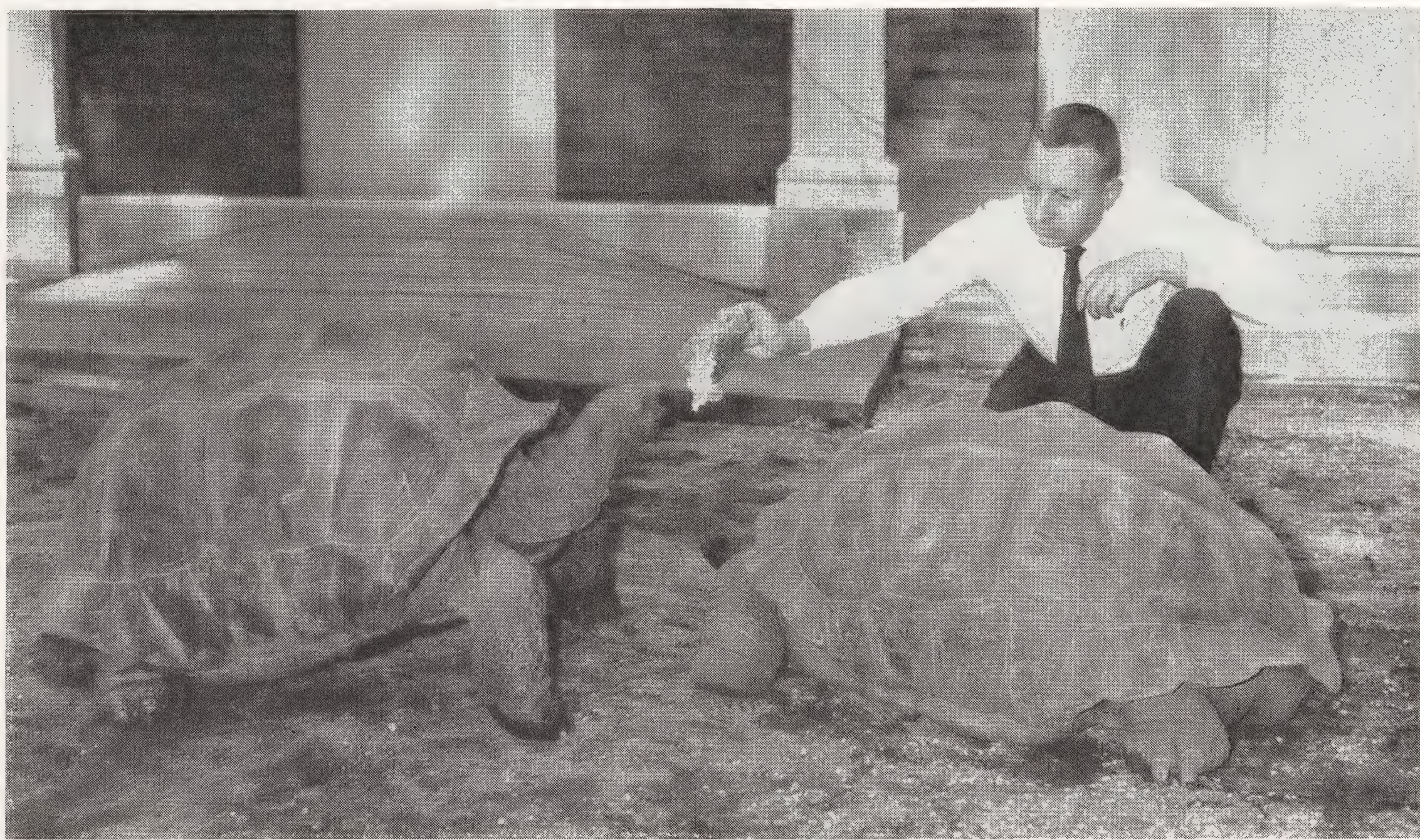
Return Gift to Japan. Last February the Bronx Zoo received one of the rarest cranes in the world, the so-called Sacred Crane of Japan, and a pair of White-necked Cranes as a gift from the Ueno Zoo in Tokyo. They were the first animal exchanges under the New York-Tokyo Sister City Affiliation Program worked out last year on the suggestion of Japanese officials. In July we made

a return shipment to the Ueno Zoo. It included two Cape Hunting Dogs, Wood Ducks, Snow Geese, Ashy-headed Geese, Cape Teal and Black-necked Swan. All had been bred in the Zoological Park. A number of Japanese, visiting New York under an exchange plan, have come to the Zoo to see the cranes from Japan.

Grant for Sponge Work. A renewal grant of \$10,800 has been made by the Damon Runyon Memorial Fund for the work of Dr. Ross F. Nigrelli, the Aquarium's pathologist, on "Studies in Sponges with No Apparent Ribonucleic Acid."

Membership Up. The Society's membership at the beginning of August was 4,073 in all classes, the highest in the Society's history.

Elms Are Going. The Dutch elm disease is making distressing inroads on the elms that shade the Baird Court area in the Zoological Park — and on the elms occurring naturally throughout the wooded part of our 252 acres. Twenty elms have been cut down so far this year, and 30 more are scheduled for removal. The loss of the Baird Court elms is especially serious, because of their prominent position in the landscaping of the



Curator Dowling takes a close look at the two large male Aldabra Tortoises (Geochelone gigantea gigantea) that came to us in July. Extinct in nature in the Seychelles, they are reared by the natives for food. Ours weigh 250 lbs. each and are our first in several years.

grounds. They were planted in 1907 when they were 3½ to 4 inches in diameter. Six big trees have already been removed from Baird Court and others are probably infected.

Tranquil Wallaby. An Agile Wallaby with an infected foot and a baby in her pouch is a delicate subject for a Veterinarian's ministrations. At what sometimes seems like the slightest and most inconsequential disturbance, a Wallaby may discard her baby — and that is exactly what happened this summer when keepers caught up the mother in the Kangaroo House to carry her to the Animal Hospital for treatment. Wrapped in a towel, the baby was carried to the Hospital also. Dr. Gandal gave the mother an intravenous injection of a tranquilizer — promazine — and a sedative, meperidine, and treated the infection. While she was still in a relaxed and calm condition, the baby was slipped back into the pouch — and there it still is. The mother made no further effort to eject it, and any day now the baby may make its first voluntary emergence. The infection yielded to treatment and the Wallaby has been returned to exhibition.

PUBLICATIONS OF INTEREST

FIELD WITH GEESE. A Book about the Domestic Goose. By Lyn Irvine. 152 pp., 14 photographs. William Morrow & Co., New York, 1961. \$4.00.

A whole book about the common, familiar, Christmas-dinner, domestic goose might not strike you as — well, likely to be entrancing. But this one is. Geese lead lives that are at the same time simple and complex and through long, patient, often almost unconscious observation of the geese on her farm in East Anglia, Miss Irvine has come to understand a great deal about them. She transmits her understanding. This is not a scientific treatise, but it has a lot of good, sound science in it, and it is written in the easy, natural, forthright style of so much nature writing by the English. — W. BR.

WHITEFOOT. The Story of a Wood Mouse. Text and illustrations by Robert M. McClung. 48 pp. William Morrow & Co., 1961. \$2.75.

The latest in a series of books by a former Curator of Mammals in the Bronx Zoo, telling of the lives and adventures of wild creatures. Excellent for young children.

DARWIN'S FINCHES. By David Lack. 204 pp., drawings and photographs. Harper Torchbooks/The Science Library. Harper & Bros., New York, 1961. \$1.40.

ANIMAL ECOLOGY. By W. H. Dowdeswell. 209 pp., drawings and photographs. Harper Torchbooks/The Science Library. Harper & Bros., New York, 1961. \$1.50.

Inexpensive, paperback editions of two well-known books. "Darwin's Finches" is a reprint of the original 1947 edition, "Animal Ecology" of the revised 1959 second edition.

THE NERVE OF SOME ANIMALS. By Robert Froman. Drawings by Charles Hagens. 250 pp. J. B. Lippincott Co., Philadelphia, 1961. \$4.95.

Mr. Froman remarks that "It is a thesis of this book that all species of animals vary more from individual to individual than we usually realize." The popular tendency is to think there is more variation than there is; in any event, it does exist, and Mr. Froman has chosen a dozen outstanding examples of animals that distinguished themselves and has told their stories with gusto. A sensible book, and good reading.

MY HOME IN THE ZOO. By Gerald Iles. Introduction by Fairfield Osborn. Illus. by 32 photographs in black-and-white. 239 pp. Doubleday & Co., Inc., Garden City, N. Y., 1961. Price \$4.50.

As a boy in London, Gerald Iles was particularly attracted by animals and was able to satisfy his interest by frequent visits to London Zoo and the Natural History Museum. When he was seventeen, his father took over the management of the Bellevue Zoological Gardens, Manchester. This gave opportunity for the young naturalist to come into close contact with animals and to develop the deep and intimate feeling for them that is evident throughout this book. This sympathetic understanding, the key to successful operation of a collection of living creatures, is manifest throughout this absorbing account of twenty-five years as manager of the Bellevue Zoological Gardens. — L. S. CRANDALL

PENGUIN ISLAND. By Cherry Kearton. Foreword by Peter Scott. Photographs. 112 pp. Charles T. Branford Co., Newton 59, Mass., 1961. \$3.50.

A new, American edition of a classic: surely the most engaging book on penguins ever written.

NATURE'S YEAR. The Seasons of Cape Cod. By John Hay. Woodcuts by David Grose. 199 pp. Doubleday & Co., New York, 1961. \$4.50.

Obviously a work of love, but rather on the wordy side. It follows the month-by-month plan.

ANTARCTICA. The Story of a Continent. By Frank Debenham. Many photographs and drawings. 264 pp. Macmillan Co., New York, 1961. \$5.50.

A vivid history of Antarctic exploration by the Founder-Director of the Scott Polar Research Institute in Cambridge. Well-written and full of information, often of a surprising kind.

GARDENING WITHOUT WORK. For the Aging, the Busy & the Indolent. By Ruth Stout. Drawings by Nan Stone. 214 pp. Devin-Adair Co., New York, 1961. \$3.95.

Another book by the author of "How to Have a Green Thumb without an Aching Back," pursuing her thesis that a rough mulch is all the gardener needs. Lively and amusingly written, and just the ticket for people who want Ruth Stout's kind of garden.

MOLLUSCS: AN INTRODUCTION TO THEIR FORM AND FUNCTIONS. By J. E. Morton. 232 pp., 23 text-figs. Harper Torchbook. Harper & Bros., N. Y. 1960. \$1.40.

For many years there has been no up-to-date book in English that describes the molluscs; that is, the snails and slugs, the clams and other bivalves, the octopuses and their relatives, and the remaining, less well known members of the great Phylum Mollusca. This book fills the void most admirably. Shell collectors should be especially interested.

LIFE IN THE AQUARIUM. By Philip Barker. xii + 162 pp., 14 illus., 48 text-figs. Charles T. Branford Co., Newton Centre 59, Mass. 1961. \$3.50.

A useful introduction to home aquarium management, both freshwater and marine, and for both exotic, tropical forms and local ones collected by the hobbyist himself. The chapters devoted to the latter are, however, directed to the English fancier and are therefore of limited value in the U.S.A.

PRINCIPLES OF ANIMAL TAXONOMY. By George G. Simpson. xii + 247 pp., 30 text-figs. Columbia University Press, N. Y., 1961. \$6.00.

At last we have it — a book on taxonomy written for taxonomists! For many years, since 1945 in fact, biologists in other fields have been suspicious of the interest shown in Simpson's "Classification of Mammals" by workers in entomology, ichthyology and, yes, even herpetology. Most "outsiders" apparently did not realize that the first part of the book was concerned with the principles of classification while the remainder was an illustration of these principles as applied to mammals.

Now Dr. Simpson has revised, amplified and more clearly explained that material of general interest to those persons who classify animals. In so doing he has produced a book that should affect the entire field. His

lucid descriptions and explicit definitions clarify the entire process and point up the divergent bases of taxonomy and classification. Perhaps more important, his statement of the nature of taxonomy as, "a combination of a science . . . and of an art" is a refreshing admission, known to most taxonomists but little understood by others. — H. G. DOWLING

LIVING AMPHIBIANS OF THE WORLD. By Doris M. Cochran. 199 pp., 220 illus. (77 in color). Doubleday & Co., Inc., Garden City, N. Y., 1961. \$12.50.

This seventh volume of the "World of Nature Series" does not lend itself to a favorable review. It has more illustrations of amphibians, many of them rare and beautifully photographed, than any other modern publication. Some of the color photographs are particularly well composed and reproduced and have subjects of unusual interest. However, I cannot believe that books of this general scope should be aimed at the television audience of retarded twelve-year-olds that the text would suggest. I doubt that Dr. Cochran is to blame, but the editors and publishers should reevaluate their requests for this kind of pseudo-scientific writing. This is a very expensive book for the knowledge that it is able to impart. — H. G. DOWLING

New Members of the New York Zoological Society

(Between May 1 and June 30, 1961)

Supporting

Mrs. Vincent Astor

Contributing

David C. Burton
Michael Elliot
Mrs. Mary E. Harmer
Irving Heilizer
D. M. Hodgson
Mrs. Max Hoffer
Horace H. Hopkins
Mrs. Rita Horowitz
Harry A. Hyman
Miss Frances A. Jones
Miss Alice C. Kraus
Nickolaus Leggett
Miss June Lord-Wood
George MacGovern, Jr.
Mrs. Konrad Matthaei
Rev. Philip A. Mulleedy
James F. Oates, Jr.
Harold C. Palmer
Dr. Francis A. Pflum
Joshua B. Powers
Sidney L. Rapoport
Mrs. Norman D. Richardson
Mrs. Jesse Roth, Jr.
James H. Sharp
Robert Shenker
Mrs. Natalie Silverman
Carlton Skinner
Wilberforce Sully, Jr.
John F. Thompson, Jr.

John B. Turner

Mrs. Harold A. Wheeler

Annual

Mrs. Rebecca W. Aghnides
Winthrop W. Aldrich
Colin Allen
Mrs. George C. Atteberry
Miss Jane Bancroft
Daniel Bartoline
Dr. Constance M. Barwise
Sam Baum
Martin Bookspan
Rollin C. Bush
Louis Carbone
Dahill Chattaway
Dominick Ciambrone, Jr.
Miss Rachel Ciambrone
Stuart Cloete
Walter E. Dean
Mrs. James Deely
Mrs. Blanche Forster
Dr. Daniel B. Freeman
Mrs. Edmund N. Goodman
Mrs. R. D. Gordon
Dickson J. Hartwell
Leonard Herman
Norman Horn
Saul H. Hyman
Mrs. John H. Jackson, Jr.
Sanford H. Jackson
Walter Kaplan
Lewis Kook
Ely D. Landau

Mrs. Harold Lato

Miss Lorna Lenley

Samuel Ligerman

L. T. Lonkay

Mrs. Joanne Mathews

Dr. Victor C. McCuaig

Master William K. McKeever

Alvin T. Miller, Jr.

Mrs. Benjamin Charles Milner, III

Willard S. Mlott

Mrs. James S. Murphy

Mrs. E. W. Ohlinger

B. C. Olney

Mrs. Guido Pantaleoni, III

Miss Susan Pritchett

Zenon Raabe

Henry Hun Reynolds

Mrs. Paul Rice

William Robbins

Baekeland Roll

Norman Saul

Harry Schorr

Philip M. Singer

Robin Still

Dr. William E. Swift

Charles Thomas

Allen Tressler

Wilfred A. Vianelli

Mrs. Margot Wallace Walther

Miss Miriam R. Weiss

Irwin M. Whitton

Trevor B. Wilfert

Mrs. F. M. Williams

Robert Yakel

Save the date of
Thursday, September 14

That's Garden Party Day!

(Well in advance, Members will
receive a detailed announcement
telling all about it)



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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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The Zoologist As a Species

THE *Zoologist* is a rather unusual creature. He is of the CLASS MAMMALIA and anthropoidal in his characteristics. His species is widely distributed throughout all the continents and even in the oceans. Members of the species can be observed on Polar icecaps, in tropical forests, sometimes in dark caverns located in intermediate latitudes and, occasionally, thousands of meters below sea level. This species has omnivorous tendencies, its interests ranging from whales to termites and even animalcules. Members of the species have been known to enunciate theories that alter the thinking of the entire race of *Homo sapiens*.

The species is not necessarily non-social but is definitely non-political. Its members appear to be extraordinarily happy life-forms that desire nothing better than to pursue their specialized activities throughout their entire existence.

Fairfield Osborn

SMITHSONIAN
INSTITUTION

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Fifty Years; a Single Purpose

By FAIRFIELD OSBORN

President of the New York Zoological Society



On the way home from China, John and the Pandas had a breathing spell at Tagaytay outside Manila — mostly spent searching for the only kinds of bamboo the animals would eat.

FEW LIVES are dominated by a single purpose. Few lives approach their years of ultimate accomplishment with steady success along the way. The career of John Tee-Van who on August 23 completed his fiftieth year in the service of our Society, can be included in the notable "few."

It can also be said that few individuals are possessed of numerous and varied talents. Usually it happens that a person has some special talent and, depending upon his particular capacity, strives towards some specific goal. Not so in the case of this man, for in his life's work, unusual in its diversity, all has been done well and all has meant much to the accomplishments of the institution he has served with such devotion for a full half century.

If these remarks seem exaggerated, let's look at the record. When only fourteen years of age, he stood before the august, bearded personality of the Zoo's Director, Dr. William T. Hornaday, pleading his case for a job — "any job with animals." There were no minimum age limits in those days, though the usual practice was to employ no one under seventeen or eighteen years old. However, there was "something about the boy" and he was signed on as a helper in the Bird Department with the munificent wage of \$30 per month, assigned to the tasks of cage-cleaning and pushing food carts from building to building. Five years passed and young Tee-Van's thoroughness and dependability became generally recognized. Meanwhile, he had been studying architectural drawing in night school. Then came the first "break." Dr. William Beebe, Curator of Birds at that time, was about to launch his career and initiate his long series of scientific field expeditions — in many respects the most varied and remarkable of their kind ever undertaken. He engaged young Tee-Van as a draftsman, artist and general handyman and so it happened that for the next quarter of a century — 1916 to 1941 — the careers of these

two men were inextricably bound together in the uniquely creative work of the Society's Tropical Research Department. The scope of activity undertaken by this Department is never likely to be paralleled — long years of study of jungle life

John Tee-Van in a relaxed moment as a Keeper in 1913. He was paid \$30 a month — a good wage for a beginner in those times.

in British Guiana, journeys to the Galapagos Islands, Venezuela, and to Haiti, and studies of ocean life in the Sargasso Sea, in the Gulf of California, and in the Bermuda waters, including the probing of life in the ocean depths and the drama of the Bathysphere's record descent. Through this span of time John Tee-Van was a man of "all duties" — devising, inventing, repairing, photographing, observing, recording — the ideal collaborator with his brilliant leader. But

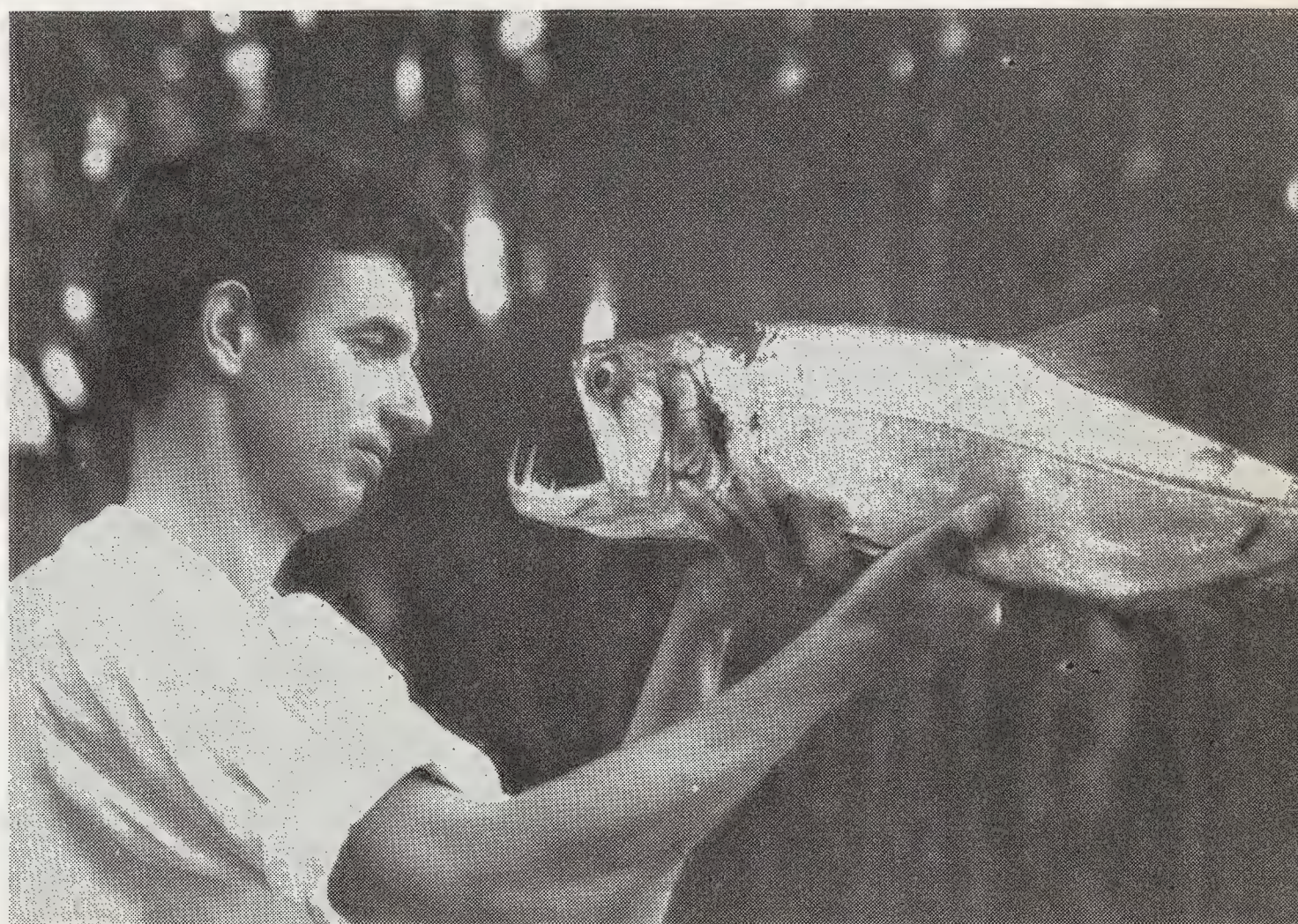
The rapt look of a budding ichthyologist was apparent as early as 1924 when John examined the fresh-water Biahra in British Guiana.

above all, through these experiences, he amassed a wide and diverse knowledge of zoology and it was during this period that his principal interest was drawn to the science of ichthyology.

Then came another turning point, when he was drawn from field research work into administrative responsibilities. In 1941 he was appointed Executive Secretary of the Zoological Park as well as Administrative Assistant to the President of the Society. At this juncture a rather dramatic

Ever curious about techniques, John learned to shoot the sun with a sextant aboard the ship on the Department's Haiti expedition in 1927.

incident occurred. A cable was received informing us that Madame Chiang Kai-shek was prepared to present to our Society two young Giant Pandas. John Tee-Van was selected for the mission of going to China and bringing the animals back to New York. It was not an easy assignment, as it involved a journey to the Province of Szechwan as well as the difficult problem of maintaining the animals in good health on the long journey home. The day after the ship left



the coast of China, the Japanese attack upon Pearl Harbor occurred, so the voyage home was made by a circuitous route in order to avoid meeting with Japanese warships. Despite these difficulties, our emissary arrived back in New York, a smile on his face, his charges in excellent condition.

In 1952 he was made Director of the Zoological Park and in 1956 General Director of both the Zoo and the Aquarium. The talents he showed as an administrator were nothing less than remarkable — thorough in details, excellent in personnel relations, wise in policy decisions. Today his administrative responsibilities are lessened with the Zoo under the Directorship of William G. Conway and the Aquarium continuing under the Directorship of Christopher Coates, so that gradually he is having more time for direct ap-

John Tee-Van brought to the administration of the Zoo all the qualities of orderliness and attention to detail that had made him so valuable in the field during his earlier career.

plication to scientific work — not that he ever departed from it, for until quite recently he was Editor-in-Chief of the definitive publication, "Fishes of the Western North Atlantic," whose giant volumes came forth under his supervision.

Through the years his interests have never been limited. He has served as President of the New York Academy of Sciences, as well as President of the Explorers Club. In 1955 he was awarded the degree of Doctor of Science by Rensselaer Polytechnic Institute. On the day that marked his fiftieth year with the Zoological Society, the City of New York gave him a citation: "John Tee-Van — who has given 50 years of dedicated service to biological history and through his own profound knowledge . . . has advanced the education of the citizens and enriched the City of New York."

* * *

That is the record. How infinitely fortunate for our institution that such a man should be in its service!





Photo by Wisconsin Conservation Department

THE MARTEN

Symbol of Wilderness

By **DAVE MECH** *Department of Forestry & Conservation, Purdue University*

SAY "SABLE" and a woman will perk up her ears like a cat in a cage of canaries; mention "marten" and she'll only react with a blank stare. A marten is a sable, and vice versa. But "sable" is better known because it is the furriers' name for the marten's valuable coat. A single pelt once brought \$200.

As might be expected, the marten is beautiful. It is a typical weasel — long, slender, curious and alert. Males average 1.9 pounds, and females 1.2. The fine, lustrous fur may range from light golden to almost black, but is most often dark brown. Yellowish-orange patches usually ornament the throat, breast and belly. A bushy tail, furry feet and relatively large ears distinguish this splendid creature from other members of its family. (Its nearest relative, the fisher, is much

larger and has shorter ears). Martens growl, hiss, snarl, screech, coo and cackle — but not very often.

Most people know little about *Martes americana* because it dwells only in the wilderness. Its range in primitive times coincided with the distribution of mature northern hardwoods and boreal forests in the East, and with mature pine, spruce and fir stands in the Northwest. Thus Alaska, Canada and the northern United States harbored these furbearers. They once even occurred in Ohio, Pennsylvania, New Jersey and Virginia.

Settlement of the East wiped out much marten habitat. The northern states retained some wilderness, however, and there the marten populations held out longest. Nevertheless, by about 1925



the species was extinct in Minnesota, Michigan and Wisconsin. A few remained in the Adirondacks of New York and in Maine when, in 1936, the U. S. Biological Survey recommended a nationwide closed season. Even though New York complied, its marten population failed to recover during the next ten years. The species appeared doomed in the United States east of the Rockies.

What caused this dangerous decline? Probably a combination of three factors: overtrapping, habitat destruction and the species' low reproductive rate.

The marten is especially susceptible to overtrapping because of its reckless curiosity and high value. Almost any kind of "set" would catch the creature, and improvident trappers often cleaned out an area, then moved on. An Ontario trapper retired after making \$16,000 in one winter (about 1920). Besides full-time trappers, there were seasonal workers, lumberjacks and other woodsmen who trapped every marten they came across.

Along with heavy trapping pressure came habitat destruction, even more harmful. Extensive and intensive logging plus widespread forest fires wiped out most of the remaining mature timber. The second growth which followed was unsuitable for martens.

Even in the few remnants of good habitat, the heavily-cropped marten population could recuperate only slowly, if at all, because of the animal's low breeding potential. Females do not bear young until they are three years old, and then they average less than three per litter.

As martens became scarcer, the government tried to breed captives. But female martens are finicky. They rarely bear young in captivity. Scientists studied their love life and learned much of interest. They discovered that the marten has a relatively long gestation period — 259 to 275 days. Individuals mate a number of times during two or three weeks in July and August. Male and female probably have little trouble finding one another, for each rubs its abdominal scent gland on logs, tree limbs, and the like as sign of its presence. Besides this, the female "clucks" when sexually receptive.

Mating lasts about one hour. The fertilized eggs develop for a few days, then stop. For the next several months the "blastocysts" float freely in the womb; about mid-February they finally attach and resume development. Mother marten prepares a warm nest in a rock pile, hollow log or tree cavity for her young, which arrive in April.

Young martens are especially curious. A Colorado biologist once spied a female and four young

bounding toward him. All stopped and stared at him for a couple of minutes. The adult and two young ran into a nearby rockpile, but the other two youngsters continued watching him. After a time the female reappeared, threatened her disobedient offspring and finally snatched one by the neck and dragged it to the rockpile; the other followed.

Marten kits are full-grown when they are four months old. By late fall they are on their own. Like the young of most mammals, they may travel far and wide before settling down. In Montana a juvenile male wandered at least 25 miles after leaving home.

This strong tendency to disperse partially accounts for a recent comeback which the marten

Boreas Pond in Essex County, New York, lies in the heart of the marten's range in the state. In this high-peak Adirondack area is probably the largest population of martens east of the Rocky Mountains.

Photo by the Author

has been staging. Wildlife refuges, State and National Parks and other havens in the wild have supported the nuclei of the few remaining populations in the United States and southern Canada. Numbers have built up and dispersing individuals are overflowing to surrounding areas. Meanwhile, vegetation on much of the slashed and burned timberlands has grown to the stage suitable for martens. These factors plus the closed season in the East since 1937 fostered the marten's recent return. Today's low raw fur prices — \$10 for a marten — should not hinder the comeback.

Naturalists noticed the increase of this furbearer in the Adirondacks about 1946. Although lately woodsmen have reported spotting martens and sign all over the "forever-wild" area, most reports come from Hamilton, Franklin and Essex Counties. Undoubtedly the highest populations frequent the high-peak country of Essex County, in the heart of the Adirondacks. In the spring of 1957 I snowshoed partway up Mt. McIntyre, second highest peak in New York, and had no trouble finding marten tracks. A forest ranger stationed in the area asserted that "they are on all the nearby mountains." The Adirondacks now probably contain the highest population of martens east of the Rockies.

Aroostook County is Maine's marten stronghold, but a few specimens have come recently from Piscataquis and Somerset Counties. There are scattered reports from Franklin and Oxford Counties. From 1949 to 1959, Maine trappers accidentally caught and reported 71 martens. A biologist in that state predicts regarding marten numbers that ". . . further moderate increases may be forthcoming."

The first marten record in Minnesota since 1920 came in 1953 from the northeast section of the state, and woodsmen report other individuals there. A few miles north, in Canada, a small population remains; dispersal from this may be repopulating northeastern Minnesota.

Since much of the eastern wilderness is becoming suitable for martens again, states not nursing remnant populations are restocking to re-establish the species. New Hampshire released a few martens in 1953. The same year, Wisconsin placed five adults from Montana on one of the large Apostle Islands in Lake Superior. Five more were released in 1956 and biologists have observed marten sign there every year since.

Michigan also has seriously attempted re-establishing the interesting creature. The conservation department released five males and three females in the Porcupine Mountains during the winter of 1955-56. In February, 1957, biologists reinforced the initial stock with 13 males and 8 females. It is still too early to tell if the plant "took," but the Michigan naturalists know that individuals were still present in the Porcupines in January of 1959.

One main difficulty in restocking the species is its homing tendency. A transplanted Michigan marten traveled 140 miles back to within six miles of its origin. This and similar incidents show that martens are travelers with strong attachments for their home ranges.

Until recently naturalists thought the home range of the marten was 10 to 25 miles in diameter. Indeed, biologists who have tracked individuals around for several days and sometimes weeks verified these figures. However, in 1957, V. D. Hawley and F. E. Newby reported on their intensive study of marten home ranges in Glacier National Park, Montana. They live-trapped and tagged 85 individual martens (525 catches). The home range of those *resident* on



Michigan biologists released 18 male and 11 female martens in the Porcupine Mountains in an attempt to reestablish the fur-bearer. Wisconsin and New Hampshire have also made efforts at restocking numbers of martens.

Photo by Cusino Wildlife Experiment Station

the area averaged .92 square miles for males and .27 for females (based on 11 adult and immature animals). These had well-defined and probably well-defended territories. But only 30 of the 85 martens were resident (captured in the same area over a period of at least 3 months). The others were temporary residents and transients; these are probably the types which the other naturalists studied.

Thus it appears that a large group of martens are more or less nomadic, while others occupy a much more restricted range. Are the wide-ranging animals surplus, forced to roam until discovering an unoccupied territory?

As we learn more about the marten, we find that some of our other old ideas are not too accurate. For instance, most natural history books call the species "arboreal." Present-day biologists disagree. Dr. W. H. Marshall of Minnesota tracked two individuals for more than 17 miles, and neither even climbed trees. A third climbed trees only eight times in 21 miles.

Dr. Marshall also noted how the animals hunted. "While moving about in timber, marten

hunt from one snag, windfall, or dense tangled clump of low brush to another often trying to approach such a feature by long leaps from the uphill side. If this 'rushing approach' fails to surprise a larger animal such as snowshoe hare or red squirrel, the marten proceeds to search every hole or crevice in detail."

Martens catch many mice during their travels. In fact, recent studies in widely separated areas show mice as their most important food. Older natural history books claim red squirrel is the marten's mainstay, but it seldom composes even 50 percent. of the food. Snowshoe hares, berries, birds and insects also are prominent on the menu.

We can readily observe the marten's omnivorous habits by watching captives. They eat everything from beef gravy to pancakes (with or without syrup). Spaghetti, however, only appeals when they are hungry. I don't think anyone has tried pizza yet.

Sometimes martens bite off almost more than they can chew. One author describes an attack on a mallard drake. The marten had dragged the duck about 40 feet, but suddenly the bird

took off, marten and all. After a 30-foot ride, the predator finally weakened the duck and had him for supper.

Martens are always hungry. They spend all of their active hours (generally several hours around dawn and dusk) in search of food. When caught in live-traps, they devour the bait and readily accept any food presented them. Immediately after being released, they usually start searching for food. In Alaska, a biologist handed a marten a candy bar upon release; the creature carried it 10 yards, stopped, and gobbled it up.

Besides misjudging both the marten's menu and its arboreal ability, naturalists of a few years ago believed that it would not get along near human beings or their habitations. These naturalists would have had a hard time convincing a certain Yellowstone camper of this. He awoke one morning with a marten in his bed! This is an extreme example of "symbiosis," no doubt, but lumberjacks, park rangers and other woods-

men in marten country testify that the creatures frequent their camps, garbage cans and dumps searching for free meals. It is not that martens can't live with people; just that they can't live where 99 and $4\frac{4}{100}$ percent. of the people live.

The marten depends upon the wilderness for its existence. We have salvaged some of the wilderness and therefore have saved the species from extinction — so far. But only through devoted and persistent effort can we safeguard the few remaining wildernesses in the East. Right now there is a move to open up part of the "forever-wild" land which supports probably the largest marten population in the East — the Adirondacks. Many people like this move; others do not. One thing is sure: the *marten* won't.

Immediately after release in the Porcupine Mountain area, the marten headed for a tree. But so bold and voracious was the little animal that in a few minutes it started hunting.

Photo by Cusino Wildlife Experiment Station



Birds on the Horns of a Dilemma

By EDWARD A. ARMSTRONG

St. Mark's Vicarage, Cambridge, England

ACCORDING TO THE FABLE, Buridan's ass died miserably of starvation between two exactly equidistant bales of hay because it was unable to decide which to eat. The story is not quite so absurd as it may seem for there are people who are almost incapacitated by having to make a crucial decision and animals may behave in apparently futile or incongruous ways when on the horns of a dilemma because of conflicting impulses or motivations. In experiments by Pavlov and his followers, dogs and sheep were reduced to a neurotic condition when, after being trained to respond in different ways to two distinct types of signal, both signals were given together. Our own mental disturbances are often due to inner conflict. The unusual forms of behavior resulting from such conflicts are of particular interest because they give us an insight into



the concealed "springs of action" of animals and men.

Anybody who watches birds attentively is likely to notice some of these odd activities which occur when an individual is thwarted, exasperated or in some kind of predicament due to conflicting impulses. Other animals behave in these queer ways, too, but they are most conspicuous and easily studied in birds because they, being relatively large and mostly active in daylight, are more readily observed than, for example, insects or nocturnal mammals. Moreover, birds' movements and utterances are so highly expressive that they reveal rather more clearly than most other animals how their behavior is motivated.

Of these forms of incongruous behavior, the most frequently observed is that for which my term "displacement activity" has been adopted and which I discussed in an earlier article in *Animal Kingdom* ("Right Thing, Wrong Time," Nov.-Dec., 1950). It has been studied especially by Dutch naturalists. Sometimes the action is not only "out of context" but incomplete. When a partridge which I was watching was approached by a large rat it neither attacked nor fled but wandered here and there apparently feeding but never actually picking up anything. I have seen a Black-headed Gull leave its nest on being alarmed and alight in the water to bathe, but



performing the movements in a flurried, incomplete way. Birds anxious to return to their nests may false-feed or strop their bills on a twig in an odd, agitated manner. When an oystercatcher or avocet is menaced by another it may take up the attitude of sleep. After a fright a bird will preen its perfectly tidy plumage and a woman will tidy her hair although it has not been disarranged. Some forms of displacement activity, such as preening, have been incorporated or "ritualized" into courtship display. These activities appear in conflict situations when a bird or other creature is torn between two kinds of action, such as to attack or to flee. When two differing motivations cancel each other, another finds expression.

Striking examples of behavior due to this kind of conflict are provided by the distraction displays of birds in which the bird appears to be injured. Such so-called "injury-feigning" occurs when a parent bird is in a dilemma as to whether to escape or remain near the young and defy the intruder. Some of these displays are so realistic that animals are deceived into following the injury-feigning bird and so lured from the nest or young. If we scrutinize the movements of such a bird it will be apparent that some resemble those made by an attacking, and others those of a fleeing, bird, so that such displays exhibit components of

Three examples of injury-feigning. Left — An Avocet flutters and appears to be crippled. Center — A female Ringed Plover gives a good example of distraction display. Right — Realistic pretense of injury by a cock Dotterel.

*Left and right photos by Eric Hosking, F.R.P.S.;
Center photo by the Author*

two kinds of behavior which have become stereotyped or ritualized into this effectively deceptive display. They may be regarded as "compromise activities."

Displacement activities were recognized by bird-watchers almost fifty years ago but more recently close observation has revealed other types of incongruous behavior. When a man approaches a falcon's eyrie the brooding bird may fly out to attack him but instead of pressing its attack home will stoop at, and kill, a passing bird. Sometimes I have disturbed a pair of small birds near their nest and seen them attack each other. Behavior of a somewhat similar kind is by no means confined to birds. A chimpanzee, after being bullied by another, will "take it out" on his mate. Similarly many a wife has been puzzled as to why her husband comes home cross until she discovers that he has had a difficult time with his boss at the office.

In such activities the *object* is incongruous while in displacement activities the *activity* is



incongruous. These activities have been called "transference activities" or less appropriately, "redirection activities." In a transference activity the behavior is aroused by the normal object or animal but deflected to a substitute object. When someone is infuriated by another person he may kick a piece of furniture or, as I have seen happen, break a pair of spectacles in pieces. In his autobiography, *Orientalism*, the distinguished administrator, Sir Ronald Storrs, tells how, when his

father accidentally broke a valuable piece of china, his mother took up a ballroom chair and smashed it to matchwood, saying "almost without emotion": "There, but for the grace of God goes John Storrs." Having thus vented her feelings her anger was assuaged. So when a bird or other animal is hindered by fear, an inhibition of some kind or an obstacle in the environment, from expressing itself, the activity may be switched to a subrelevant object.

Thus it is normally when a bird is daunted in some way that it performs a transference activity. Blackbirds will threaten each other near the boundaries of their territories but occasionally the procedure is more elaborate. I have seen one pick up a leaf and, holding it aloft in her bill, advance towards her rival. Day after day she did this. This odd performance can be interpreted when we remember that perturbed and enraged

The head of an enemy — in this case a Cuckoo — has been affixed to the perch and two Willow Warblers made a direct, vicious attack.

Photo by Eric Hosking, F.R.P.S.

birds will pick up leaves or pull at tufts of grass. When I came near to a raven's nest it plucked the grass around. These innocent objects were evidently substitutes for the enemy. So the leaf to which the blackbird transferred the impulse to peck her rival became a banner in the bird's threat ritual. Thus transference activities as well as displacement activities can be ritualized into display. Birds as different as peacocks and birds of paradise pick up objects such as leaves or twigs during their display. The Magnificent Bird of Paradise plucks leaves off the bushes at its display-ground in the forest. Bower birds collect bright objects which they place in and around the bowers where they display and mate. All these display activities appear to be engendered from transference and non-correlation activities.

Occasionally a bird, after performing a transference activity, then performs the true activity. It is as if performing the easier activity prepared the way for one more difficult. An ape or child called on to perform some manipulative task may fail, go off and perform an easier task, and then return to try again. Dr. V. D. A. van Someren was watching at the nest of an East African Fiscal Shrike when the female began to behave in an

odd way, loitering to an unusual extent after delivering food to the nestlings. Eventually she plucked a dead leaf from a twig and flew away with it. A little later she returned and after moving uncertainly around the nest, seized an egg and went off. Presently she reappeared and removed the other addled egg. Evidently the bird's impulse to remove the eggs was hampered by the necessity to alter the normal relationship to them and by their being rather awkward objects to hold and carry away. So the impulse was at first transferred to the leaf.

In another kind of queer behavior the activity is deflected to a substitute object but this is due, not to the daunting aspect of the normal object nor to any inhibition or obstacle but to the absence of the object normally involved in the activity. Most small birds carry away the droppings of their nestlings but a Carolina Wren has

been seen to carry off a leaf and I have observed a Dipper take away pebbles when there was no faecal sac to remove. It seems that the bird is "keyed up" to act in some definite way and in default of the proper object the activity is transferred and expressed in relation to a substitute. If a bird has its attacking impulses aroused by hearing a recording of the song of its species or by seeing its reflection in a mirror, it may, in the absence of the proper object — another male — pull its nest to pieces or attack a twig. Some years ago (*Ibis*, 1952), I included such activities in my definition of transference activity but they differ in that the proper object is absent. The activity is incorrectly correlated with its goal so these activities may be called "non-correlation activities." There are human analogies to such behavior. A famous Cambridge professor who always wore his academic hood over his gown in chapel absent-mindedly took down his laundry bag from the peg and wore it instead! But this is not to suggest that his motivation was identical with that of the birds mentioned.

An extreme is reached in the most peculiar of these incongruous performances — "vacuum activity" or "overflow activity" — in which the activity goes off "in the blue" in the absence of both the initiating object and the goal object. Not only will a bird attack a stuffed specimen of its own species or a predator placed in its territory but sometimes it will attack the empty space after the model has been removed or the enemy has disappeared. A captive Starling has been seen to peck at a window pane as if it were catching flies, when there were no flies there. Our knowledge of these activities has been increased by experiments in which electrodes were inserted into the brain of a hen. It was found that attacking, fleeing and other forms of behavior could be evoked in a laboratory where there was no rival to attack nor predator from which to flee. This work shows that behavior may be composed of discrete trains of activity. Thus stimulation in the correct area of the brain stem will cause a fowl to crane its neck, look all around and then make off in a stealthy crouching posture — the series of



The head was finally removed but in the Warblers there was still an impulse to attack — and so this one continued to assail the perch.

Photo by Eric Hosking, F.R.P.S.



movements normally made by the bird on sighting a marauder.

An animal acts in a normal effective way when there is the correct correlation between inner impulse and the stimulus object but, as the instances quoted show, the former can be so powerful that the activity goes off *in vacuo* and also the latter may have such significance that it becomes a supernormal stimulus so that the activity occurs when the inner impetus is below normal. A non-correlation activity occurs when the inner impetus is so powerful that in the absence of the normal goal it is performed with a substitute object. In a transference activity, expression of the activity in relation to the initiating object is impeded and there is deflection to a substitute object. When a vacuum activity occurs, both initiating object and goal object are lacking.

Thus one or other of a range of peculiar activities may occur when the correlation between inner impetus and outer stimulus is in one way

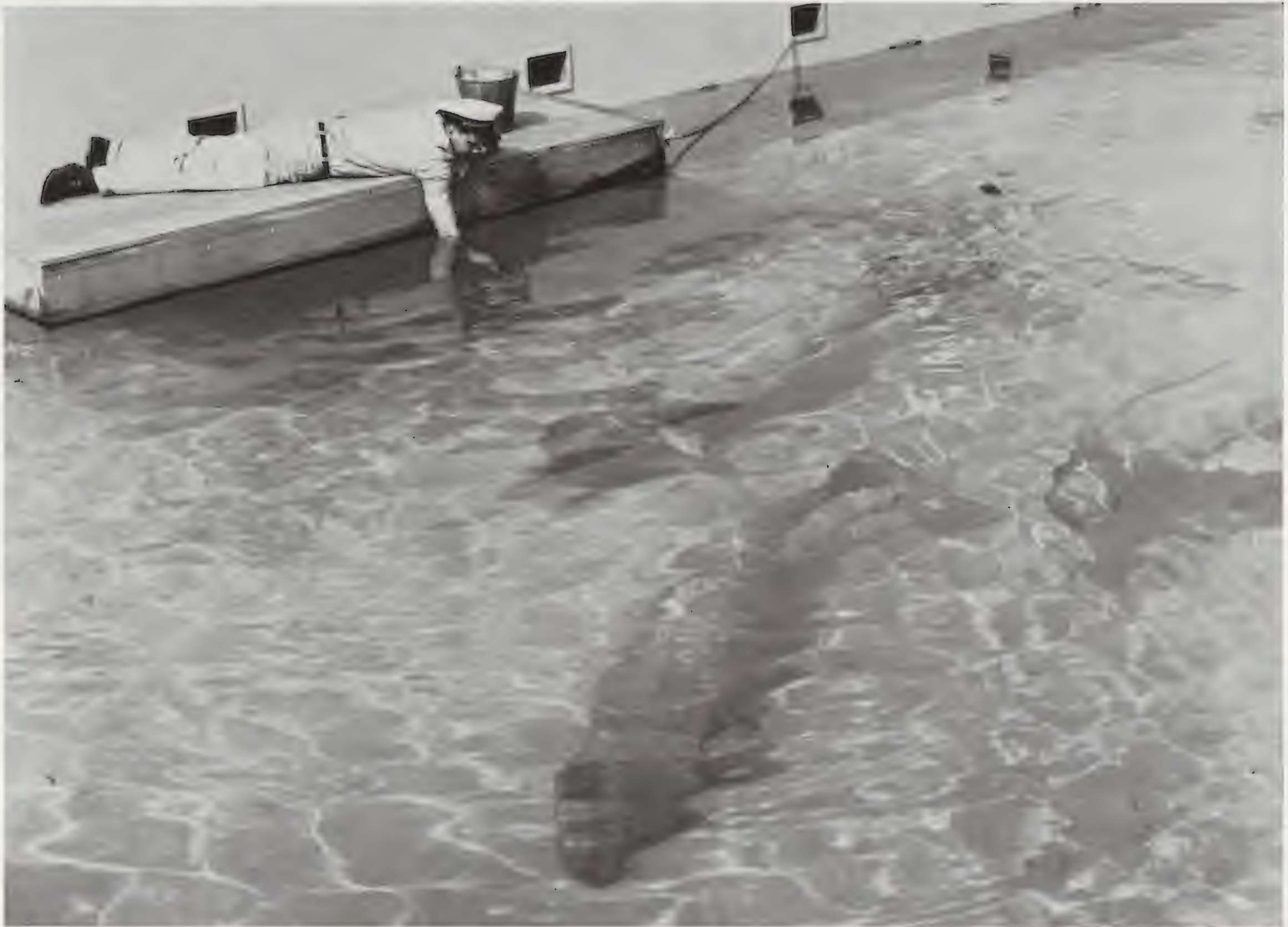
When an Oystercatcher or an Avocet has been menaced by another of its kind, it may take up an attitude of sleep. In this picture, the Oystercatcher was frightened by its image in the mirror, and goes into a posture of sleep.

Photo by Eric Hosking, F.R.P.S.

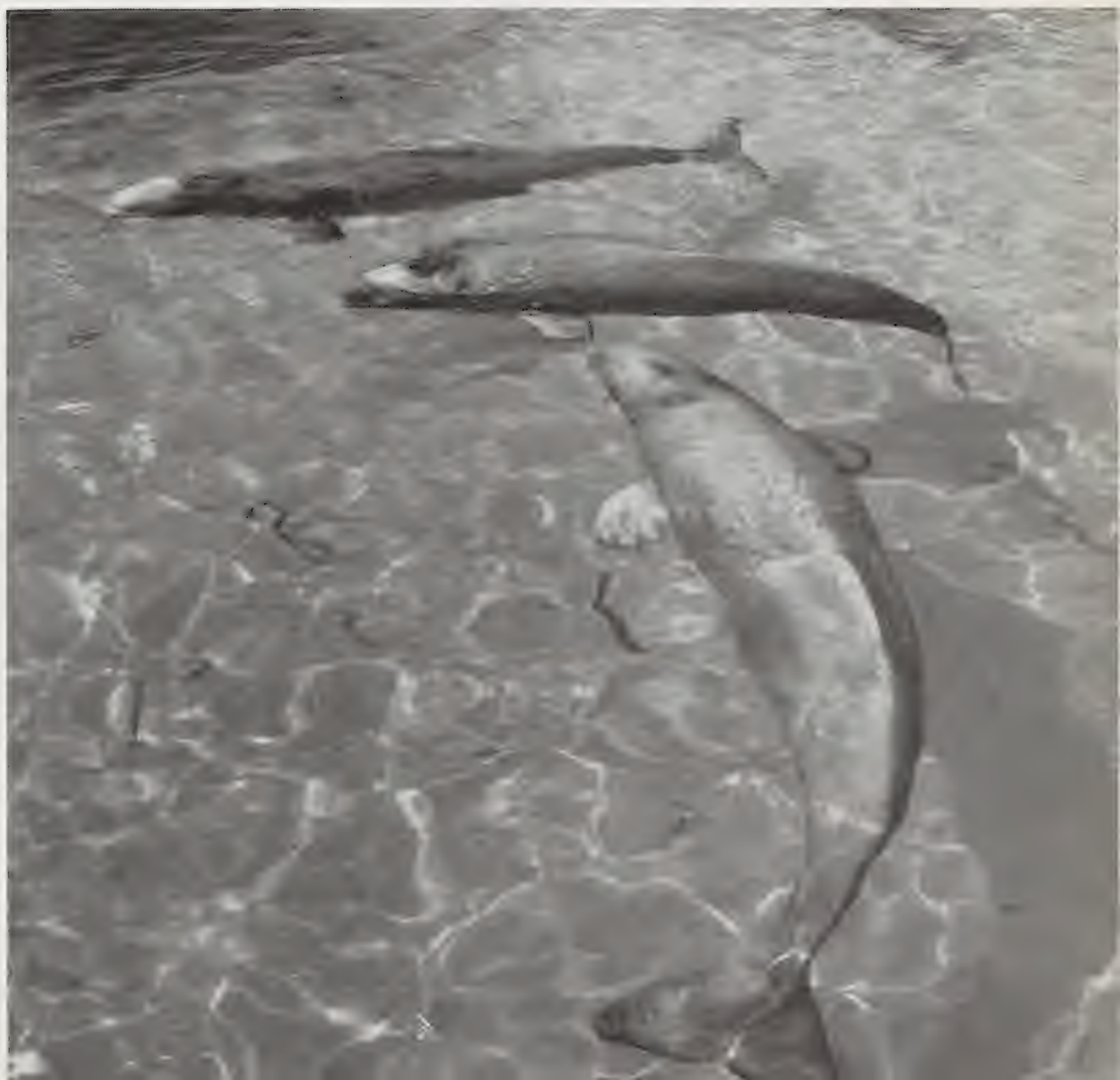
or another inadequately effected. At present we are at the stage when noticing and describing these eccentric forms of behavior are important. There are opportunities here for field naturalists as well as researchers, for pet keepers, aviculturists and visitors to zoos. We are forced into picture-thinking in trying to interpret these activities because the mechanisms which govern behavior are so little understood, but effort devoted to their study will be well rewarded. We shall find that what is learned of the springs governing animal activities illuminates our own behavior and that scrutiny of oddities in our behavior can help us to interpret the activities of other creatures.

Zoo News in Pictures

Photographs by
SAM DUNTON



The most spectacular exhibits at the Aquarium this fall are three Belugas, or White Whales (*Delphinapterus leucas*), captured by an Aquarium expedition in Bristol Bay, Alaska, and brought back to New York on August 28. The expedition was organized and led by Dr. Carleton Ray and included W. Robert Moore, Chief of the Foreign Editorial Staff for National Geographic Magazine, who acted as photographer, and Seward Johnson of Princeton, who made a motion picture record of the capture. The male Beluga is a year old, 7 ft. 3 in. in length and weighs about 450 pounds. The two females are 9 ft. 2 in. and 9 ft. 4 in. respectively, weigh between 700 and 800 pounds, and are two years old. The heavier animals were extremely difficult to lift out of the shallow water of the bay into a small boat, and once captured they had to be carried 40 miles to an airport, from where they were flown to New York in a chartered plane. They are exhibited in the big Oceanic Tank at the Aquarium and are feeding on small fish. A feeding platform has been built in the tank, and the Belugas are learning to swim up and take fish offered by hand, but are still slow learners.





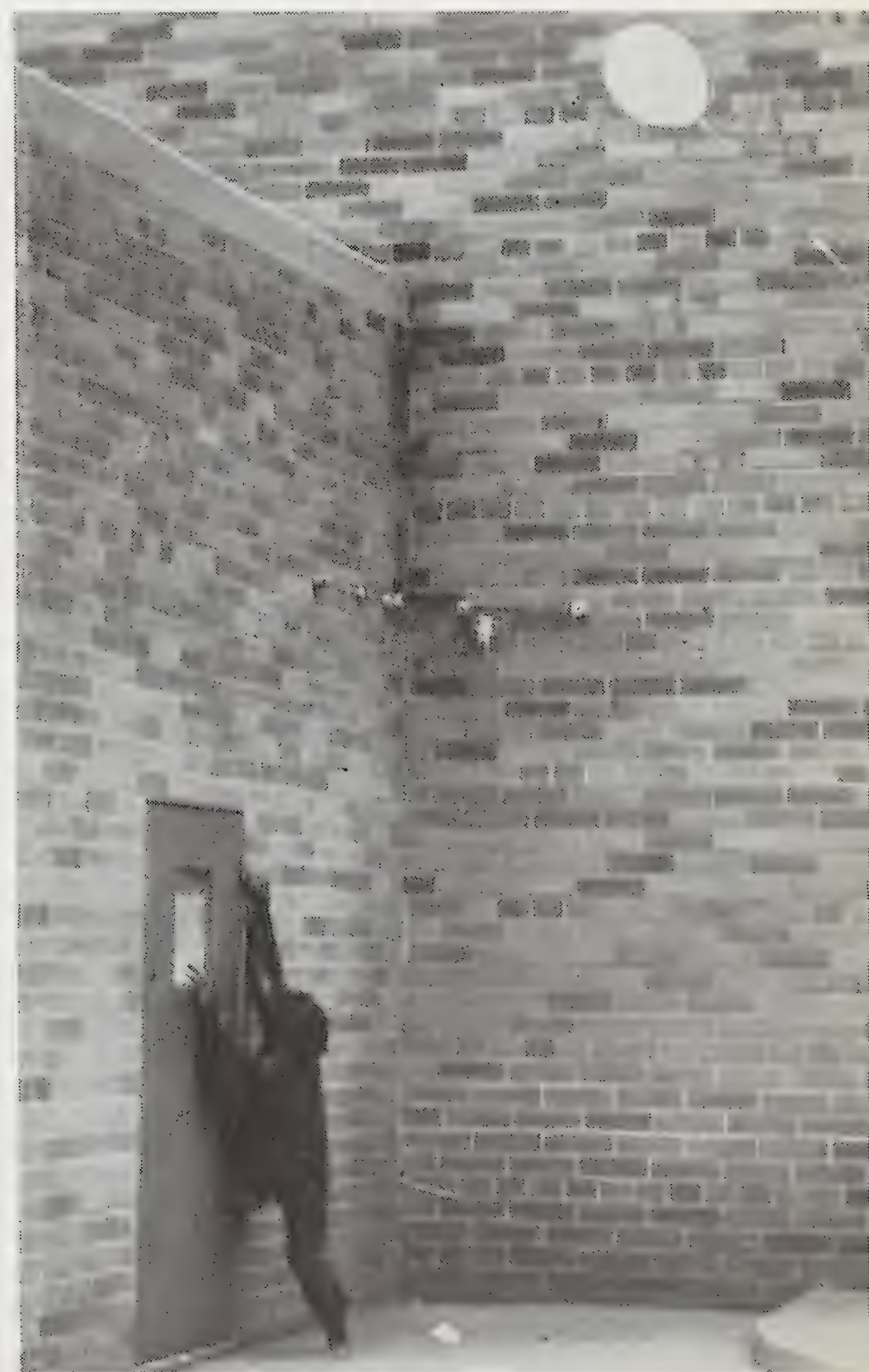
One of the rarest lizards in the world came into the collection in September. It is called the Bornean Earless Monitor (*Lanthonotus borneensis*) and this is the tenth specimen ever collected — the first one seen alive outside of its native Borneo. The monitor was sent to us by Dr. Tom Harrison, Curator of the Sarawak Museum in Kuching, Sarawak. Rough-scaled, 13 in. long, it is a burrowing species so primitive that it may be one of the ancestors of snakes. We know little of its habits in its native Borneo.





During the unseasonably hot weather in early September daily hosings of the elephants made the weather more bearable for them than for many of the human occupants of the Zoological Park. Elephant faces are not formed for fine shades of expressiveness, but there does seem to be enjoyment in the picture at the left. The African Elephants usually treat themselves to a dust bath after their shower — and certainly enjoy it.

Our young Chimpanzees — the “Little Women” — get a great deal of enjoyment out of playing with balloons and handle them much as human children would. When one floats away they often leap or try to climb fast enough to catch it.





The Practical



Conservation of LEATHERBACKS

By OLIVER MILTON

Southeast Asia Conservation Expedition

An interesting attempt at practical conservation is being made in Malaya where — without some such effort — the giant Leatherback Turtle appears to be in danger of extermination because of raids on its breeding grounds. The report that follows was sent to us by Oliver Milton, now in Malaya as leader of the Southeast Asia Conservation expedition, which is sponsored by the Zoological Society. — EDITOR

ALTHOUGH the Leatherback Turtle, *Dermochelys coriacea*, is the largest sea turtle in the world and may attain a length of seven and a half feet and a weight of 1,200 pounds, and furthermore is found throughout the tropical seas, by no means all its breeding places are known. This is probably extremely fortunate — judging by what has been happening on the east coast of Malaya where one breeding ground is known.

Along this stretch of soft, sandy beach some fifteen miles in extent, north of Dungun in the state of Trengganu, the annual visits of female Leatherbacks commence some time in May and continue until July. The billiard-ball-size eggs are regarded as a great delicacy and are systematically collected by licensed persons throughout the nesting season. The licenses are issued by the Trengganu state government and entitle the holder to remove 100% of the eggs. The result of this total collection is that there are now be-

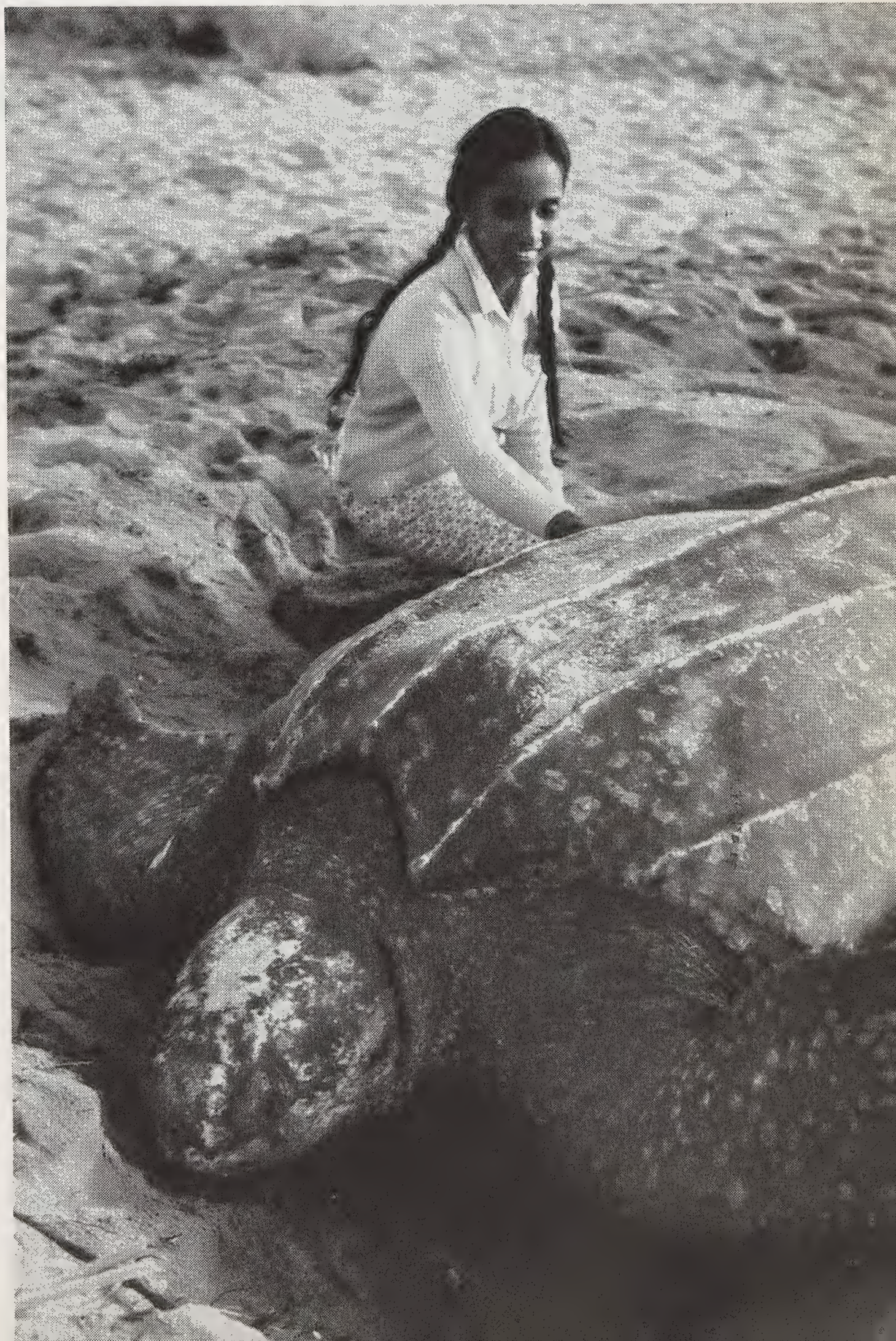
lieved to be no more than two thousand turtles left and so unless some plan for their preservation is put into effect urgently these magnificent reptiles are faced with speedy extinction.

For the past nine years Prof. John Hendrickson of the Zoology Department of the University of Malaya has been very concerned about the problem and his hopes for their preservation had met with little success. This year, however, he is seeing the fruits of his efforts and from June 17 to 19 he led a party of members of the Malayan Nature Society to the turtle beach to put his scheme into practice. The plan was quite simple, namely, to collect the eggs from the nests, pay the licensed collector for them and then place them in a guarded hatchery. Once the young had hatched they would be returned to the sea. The Treng-

Looking as if a caterpillar tractor had crawled up the beach, these tracks — more than seven feet wide — show where a Leatherback Turtle came out of the sea at Dungun to deposit her eggs in the moist sand.

All photos by the Author

The enormous size of the Leatherback is illustrated here. Estimates vary as to the weight attained by this largest of sea turtles, but it is certainly 1,200 and perhaps 1,500 pounds.





The egg-laying has started — in this instance, in the afternoon, although most laying was done at night. Some eggs may be seen under the left flipper at the bottom of the hole, about two feet deep.

After the eggs are deposited, the turtle scoops sand over them with the rear flippers. Here the clutch, which averages about 90 eggs, has been completely covered and after patting the sand down, the turtle will return to the sea.



ganu state government agreed to this and, in fact, contributed Malay \$2,000 (U. S. \$700) to the project. Incidentally, the trade in turtle eggs brings in a revenue of M\$20,000 (U. S. \$7,000) per annum to the local government. By this method the licensed collectors would not be deprived of their income, normally earned by selling the eggs in the local and distant markets such as Singapore and Penang, and the eggs would be given a chance to hatch rather than find their way into the stomachs of the gourmets.

I was a member of the group that went to the east coast to collect the eggs. Thirty of us drove the 260 miles in a hired bus from Kuala Lumpur to Dungan on June 17. We left at 7:20 a.m. and arrived at the beach at 11 p.m., having stopped at Kuantan for a very welcome supper.

Other people came by their own transport and a small party flew a chartered plane up from Singapore. Prof. Hendrickson divided us into groups of twos and threes and each group was spaced at fairly equal intervals along the 15-mile stretch of beach, those at the north and south ends receiving assistance from a Land Rover.

The turtles started to come ashore at about 11:30 p.m. and continued to do so until 4 or 5 a.m. Measuring seven or more feet in length and weighing an estimated 1,500 pounds, these giant reminders of the past would suddenly loom out of the shallow water. Paddling their three-foot flippers, they struggled up the beach until they found a site that appealed to them for nesting. Having decided on a spot, their rear flippers slowly and quite efficiently dug down

into the soft, moist sand. The flippers were used alternately and, like a human hand, the tips scooped up a quantity of sand and deposited it in a small pile at the edge of the hole. Once the correct depth had been reached — about two feet — the egg laying process commenced. Covered with a mucus, the soft-shelled eggs dropped into the hole, plop . . . plop . . . plop . . ., until all had been laid. One nest contained 33 eggs and another had 161; the average was about 90 eggs. On completion the rear flippers shoveled the sand back into the hole and then the turtle slowly moved all over the nesting site, scattering the sand in all directions, so that the actual nesting hole was completely unrecognizable.

The whole process took about one hour, during which time the monster emitted loud gasps and grunts while the fluid discharged from the eyes and which is normally washed away in the sea, congealed into strings of “tears.” Once satisfied that her reproductive duties had been completed she manoeuvred her great body around and started the journey back to the China Sea. Before vanishing from sight completely she raised her head above the water as if to take a final look at the nest and to say good bye.

The normal procedure, once the eggs had been laid, was for the licensed egg collectors to find the nesting site, clearly indicated by the great tracks leading to and from it, and then probe the area with a long metal rod until their trained fingers could sense the actual eggs beneath the surface. Then digging the sand with their hands until they reached the egg chamber, they would remove all the eggs except some small ones the size of ping pong balls, which they discarded on the beach. The saleable eggs were then heaped in a mat basket and taken to the main collecting point.

As our party consisted of 70 persons, there was not much patrolling to be done. Often the turtle was seen on its way to the nesting site, in which case it was followed — or, if it had started to lay the eggs, one person removed them as they were delivered from the huge body. They were then

taken back to the hatchery where a small group of us were digging artificial nests. During the first night no turtles came up in my sector of the beach. I saw some on the second night before going to work in the hatchery with three other persons. We removed the top layer of sand from a small area and then, when we reached the moist and less runny sand, scooped out a vertical hole about the size of one's arm until the armpit was level with the top of the hole. At the bottom of this narrow tube a round chamber was excavated about a foot in diameter, although the size depended on the number of eggs that were going to be deposited. After the eggs had been carefully laid in this prepared chamber, the hole was refilled with sand and a small metal plate, affixed to a stick, was placed in the sand by the nest. The marker indicated the serial number of the nest, the number of eggs and the date. On the first night we collected 5,000 eggs and on the second about 3,000, for which the licensed col-



Professional turtle-egg hunters with mat baskets packed with eggs, on their way to market. They are carrying the slender metal rods they use to probe the sand and find eggs at a nest.



This fenced area on the beach near Dungun is the nursery where nearly 8,000 eggs were deposited by the conservation crew to hatch. A very high proportion did successfully hatch.

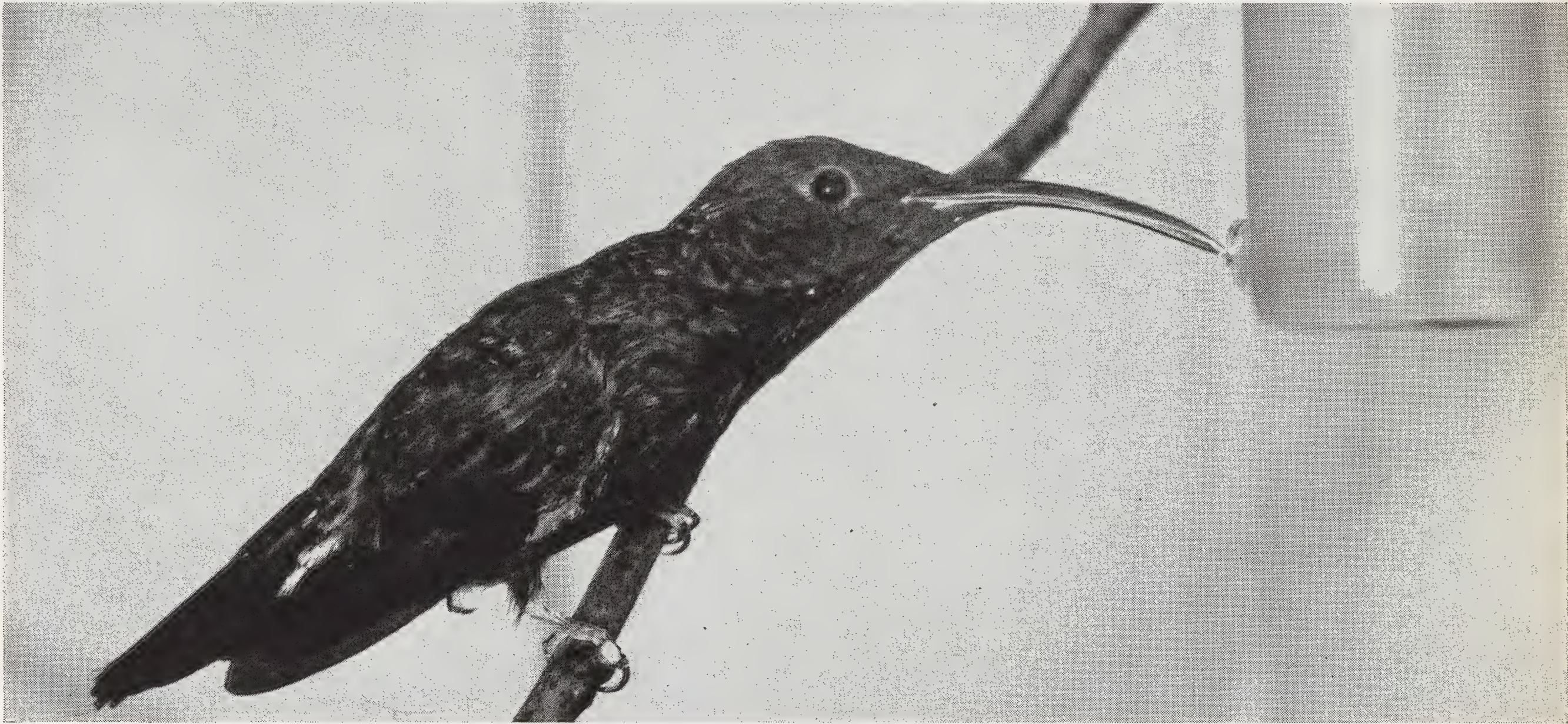


lectors were paid at the rate of M\$9 (U. S. \$3) per hundred.

Prof. Hendrickson took 200 eggs back to the University and placed them in a sand box warmed by lamplight. About mid-July he opened one or two of the eggs and found that the embryo had developed into a miniature turtle complete with distinctive carapace. Next month, when the two months' (approximately) incubation period is completed, a party will return to the hatchery to collect the young turtles as they emerge from their sandy nests, place them in trays and take them out to sea. Because of predators such as dogfish, sharks and birds, the infancy mortality is about 99%. As the local natives have never seen the young turtles remain for any length of time in the shallow water near the beach, the exclusion of this period of their life cycle by taking them out to sea may be an important factor in lowering their presently very high death rate.

They Show Their Age — HUMMINGBIRDS WITH WRINKLES

By WILLIAM G. CONWAY *Director and Curator of Birds, New York Zoological Park*



ON JULY 21 our Emerald-throated Hummingbird achieved eight years in the Zoo and, exactly two months later, September 21 marked the completion of eight years in the Jewel Room for our Garnet Hummingbird. A Garnet Hummingbird lived for eight years in the collection of Sir Alfred Ezra in England, but this is the only comparable record of which we are aware.

Of course, as the Curator of Reptiles is always pointing out, the oldest Zoo resident is "Teddy," the South American Tortoise presented by Theodore Roosevelt in 1914, and the Mammal Curator lets no one forget that "Bessie," the Indian Rhinoceros, came to us in 1923. For that matter, the Bird Department's South American Azure Jay arrived at the Zoo in 1925, and there are several other Zoo inhabitants who survived the crash in 1929, maintained equanimity through the explosion of the first atom bomb, and remain indifferent to the exploits of various astronauts.

On July 21 this Emerald-throated Hummingbird attained the very advanced age of 8 years in the collection. Its age when it came to the Zoo is not known, but it was already an adult.

Despite their lack of seniority, our two hummers surely hold the longevity record for hummingbirds in any North American zoo, and very probably have been on public exhibition longer than any hummers in any zoo anywhere. This represents no small caretaking feat, and the Zoo's bird men can rightfully feel almost as proud as the birds themselves.

Hummingbirds are extraordinarily delicate creatures — but tough as nails too. A contradiction — but hummers *are* a contradiction, from respiration to reproductive rate. They live, most of the time, at an incredible pace even for a bird.

In many ways birds are more efficient than we mammals — especially when it comes to blood circulation. For one thing, they have relatively

larger hearts than mammals, and hummers have proportionately the largest hearts of all. According to Portmann, a hummer's heart may account for 19.8% to 22% of its total body weight. A man's heart is about one-half of one percent of his body weight. Odum recorded a Ruby-throated Hummingbird's heartbeat at 615 per minute, and we may be fairly certain that this is a minimum figure for an active hummer, for a chickadee's heart may beat 400 times a minute when it is sleeping, and double this rate when the bird is active. An excited canary's pulse may rise to 1,000 per minute. Generally speaking, there is evidence that some birds have proportionately more red blood corpuscles and a higher concentration of sugar in the blood than mammals, and they usually have higher blood pressure and body temperature as well. One study has revealed a metabolic rate for an active Allen's Hummingbird more than fifty times as fast as that of human beings.

Normally, bird temperatures run from 105°F. to 112°F., with active hummers at the high end of the scale, as usual. This terrifically high physiological performance and efficiency is made necessary by small size and the energy demands of hummingbird flight, but certain small mammals, especially shrews, could hardly be called metabolic sluggards.

The common House Mouse has a reported heartbeat of 700 per minute while resting, and the Short-tailed Shrew or Mole Shrew vibrates away with a pulse of 618 to 780 per minute — not to mention a respiratory rate well over 5,000, even though its body temperature does not normally exceed 100°F. The respiratory rate of the Smoky Shrew has been recorded as high as 13,700 per minute. We humans, who draw breath only about 18 times a minute, are barely breathing by the standards of small birds and mammals.

With such a metabolism, it is a wonder that our tiny hummers could attain an age of eight years, and usually hummingbirds don't. There are, moreover, some impressive life expectancy differences between small birds and their larger, and in some ways, opposite numbers in the mammal world — the mice and shrews. No House Mouse, so far as we know, has ever lived much beyond four years. The Short-tailed Shrew is

elderly at 16 months and probably dead before it reaches 30 months. Even the relatively large White-footed Mouse has failed to attain six years, despite the protection of captivity.

Here it should be emphasized that the protected captive life span of the creatures we are discussing is quite a different matter from average life expectancy in the wild.

David Lack has amassed data which indicate that the annual death rate, in temperate areas, for various wading birds and gulls, lies between 30% and 41%, and between 40% and 60% for various songbirds, ducks and gallinaceous birds. This means that the average "further life" for the gull you spotted on the beach last week is two to three years, and for many of the songbirds in your garden, one to two years. In fact, while the European Blackbird has survived 20 years in captivity, one and a half years is close to average expectancy in the wild. Small rodents show similar annual mortalities in the wild, but, even in captivity, do not usually have the potential life span of comparably-sized birds.

A high reproductive rate such as that of the chickadee, which averages 6 to 8 eggs in a nest, or the Bob-white, which usually lays about 15 eggs in a clutch, is often associated with a short average life and a high death rate. Swifts, penguins and condors, for example, reproduce slowly and seem to live relatively long lives. Almost all of the more than 300 species of hummingbirds deposit two eggs in a clutch, so we might consider this an indication of potentially longer lives. However, the significance of the small hummingbird clutch is hard to assess, for the clutch size must be regulated, to some extent, by the maximum number of young for which the parents can reasonably provide food. Feeding hungry baby hummingbirds must certainly approach the ultimate in parental responsibility.

The terrific energy requirements of hummingbirds would seem to require a constant food intake, even at night. While we don't know the full story yet, it appears that hummers go into a state of torpor at night during which the body temperature and metabolic rate fall sharply. O. P. Pearson recorded the emergence from torpor of Allen's Hummingbirds. During the minutes from torpor to flying, he found their respiration gradually increased to a very high rate and then



Head Keeper Bell insists that the Garnet Hummingbird, which had been in the collection 8 years on September 21, actually has "bags under its eyes" as a result of its advanced age. This close-up photograph seems to bear him out. The 8 years equal a previous record of the species.

dropped to a more normal rate as the birds became active. Pearson noted further that a male Anna Hummingbird consumed eight times as much oxygen during the day as it did in torpor at night. The mechanism of torpor in which the hummer slows down substantially for a long period each night may be of major importance in its unexpectedly long life.

At the Zoo, all of our hummingbird cage lights are carefully regulated to give our birds a minimum of 12 daylight hours for feeding, for experience has shown that hummers, despite their ability to sink into torpor, rapidly exhaust their food energy reserves.

Every zoo man knows that large birds generally eat proportionately less than small ones, but hummers carry this rule of thumb to the point of ridiculousness. The Emerald-throated and Garnet Hummingbirds regularly consume about three times their body weight of our special formula syrup each day. From the bird keeper's standpoint, this means that we must keep food constantly before our hummers. L-shaped feeding tubes are replenished at least twice each day and placed at just the proper angle for each bird. Imagine performing this service 5,840 times without a misstep! That is what eight years of a hummingbird's life means to a keeper.

Crawford Greenewalt, in his magnificent hummingbird monograph, assembles an awesome full bushel of quotable facts and illustrations about hummingbird food requirements, which, though they might make a physiologist cringe, put the matter on a spectacularly comparative plane.

"Hummingbirds have the highest energy output per unit weight of any living warm-blooded animal."

"A man's actual daily energy output is about 3,500 calories. The daily output of a hummingbird leading its ordinary life — eating, flying, perching, sleeping — if calculated for a 170-pound man, is equivalent to about 155,000 calories."

"A normal man will consume two to two and a half pounds of food a day. If his energy output were that of a hummingbird, he would have to consume during the day 285 pounds of hamburger, or 370 pounds of boiled potatoes, or 130 pounds of bread."

Our hummingbird diet is composed of a special liver protein hydrolysate, a cereal-based baby food,

beef extract, sweetened condensed milk, pure honey, liquid vitamins and water, all mixed to form a thin, beige-colored, sweet-tasting syrup. Live fruit flies are bred for the hummers and are an important supplement. The ration is calculated to provide approximately the same amount of fat and protein our other bird diets allow, with, however, very high carbohydrate and sugar percentages. The sugar-water or, preferably, honey-water mixtures that many people use to attract hummingbirds to backyard feeders are not adequate to maintain the birds more than a few weeks as a sole diet. Like other animals, hummingbirds must have protein, fats, carbohydrates, vitamins and minerals. In the wild, hummers feed to a great extent upon insects, and flower nectars probably act chiefly as sugar sources to meet their demanding energy requirements.

Adventure among our Zoo hummingbirds is held to the absolute minimum, but once every six months or so a worried old Emerald-throat, an alarmed old Garnet Hummer, a nervous Head Keeper and a perspiring Curator assemble over a small table behind the Jewel Room for a mutually frightening adventure. It is toenail-clipping time. Hand-catching and holding sixteen years' worth of hummingbirds might best be compared with trying to bunt a Christmas tree ornament with a baseball bat. Yet, if the toenails are left unclipped, the birds will eventually become crippled. So far, the operations have all been uneventful. Perhaps we worry too much, for, as birds go, hummers are rather fearless. In Trinidad, wild ones have investigated the buttons of my shirt, one by one.

I would rather like to say that our Emerald-throated and Garnet Hummingbirds are bird personalities and have pet names. But the fact is that neither bird has distinguished himself (both are males) as an individual. Any individuality they possess is more obvious in appearance than in behavior. After all, they expend so much effort in mere living that it seems uncharitable to expect character as well.

Neither of our old hummers shows much sign of age — except for wrinkles. Scoff if you care to, but our Garnet-throated Hummer shows definite wrinkles about his eyes — positive bags, Head Keeper Bell contends. And neither bird seems quite so spry as it was a few years ago.



Keeper Robert Brandner has devoted himself to setting a longevity record for Bushmasters.

THE ZOOLOGICAL PARK received a Bushmaster from our good friends at Simla, the Society's Tropical Research Station in Trinidad on July 21 of last year. On the same date this year I was able to report that this Bushmaster was still living in the Reptile House. In these days of reptile-keeping, such a report for most snakes would be meaningless. In fact, hardly anyone is even mildly interested in the longevity of a snake until it has passed its first *decade* in captivity. Why, then, should a year's record for a Bushmaster be important?

It is only if you examine the past experience of this Park and other zoos with this particular species (*Lachesis muta*) that the record begins to suggest its true importance. Raymond L. Ditmars, the first curator of this department, after a long tenure and after many attempts to keep Bushmasters, was forced to report (in 1931) that "not one specimen has been induced to feed . . . there is always difficulty in shedding the skin . . . (and) life in captivity is, at the longest, four or five months."

In 1935 Dr. Ditmars received a specimen from Prof. F. W. Urich of Trinidad that lived for almost a year in the Reptile House. Counting the eight months that it was in Prof. Urich's posses-

Our Air-conditioned Bushmaster

By **HERNDON G. DOWLING**
Curator of Reptiles

sion, it lived for 20 months in captivity — a period that is still the world's record. But this merely seemed to be the "exception that proved the rule." All other Bushmasters in the Zoo died with discouraging regularity. Even in Trinidad itself, Mr. R. R. Mole, who probably knew more about Bushmasters than any other person in the world, had been able to induce only a single individual to feed. He maintained it for 16 months.

After the Reptile House was renovated in 1954 a strange fact was noticed. While the longevity of most reptiles improved enormously under the new conditions of improved cages and regulated temperatures, that of Bushmasters actually *decreased* from four to five months to something less than three. My predecessor as reptile curator, James A. Oliver, had noted this effect and, having visited Trinidad himself, suspected that the constantly high temperatures of the Reptile House might be affecting these animals adversely. In fact, as he has previously reported (*Animal Kingdom*, 1957, vol. 60, no. 6), by keeping a Bushmaster behind the scenes and at a relatively low temperature, he was able to persuade it to feed nine times in the five months that it lived. My own 1960 studies of the temperatures in Trinidad at the times and places where Bushmasters were abroad had confirmed that they were active only at low temperatures (See *Animal Kingdom*, 1960, vol. 63, no. 3). On the basis

of these observations in nature, the individual that I brought back in March of 1960 was placed in the new air-conditioned section of our Reptile House, and was joined there later by the present specimen. Both snakes fed fairly regularly and appeared to thrive, but the March specimen died after about six months in captivity, not from the usual reasons of overheating and starvation but merely from the lack of sufficiently devoted attention to its other narrow requirements.

It was at about this time in the fall of 1960 that Robert Brandner, one of our reptile keepers, took the longevity record for Bushmasters as a personal challenge. Now that the basic rudiments of Bushmaster care were known, he decided to create an outstanding longevity record.

The first step was to provide an adequate enclosure for our now lone specimen. By knocking out some of the spacers in the air-conditioned exhibit section, we were able to provide a double-sized cage. To insure the high humidity that seemed to be necessary, we covered the floor of the enclosure with sphagnum moss that could be kept damp. A rock was placed in one corner to give the snake the opportunity of retreating from this damp surface if necessary and a section of a hollow log was provided in the other corner to give it a sense of security. The amount of light entering the enclosure was reduced to keep daylight from being such a shock to this nocturnal creature. Finally, a humidity indicator and a thermometer were hung in the cage to provide exact information.

Even in the air-conditioned section it was no small chore to keep the enclosure cooled to its proper temperature. The solid masonry walls of the Reptile House, uninsulated here as elsewhere, allowed too ready a transfer of heat for the air conditioning unit to cool the entire section to the necessary 65 degree level. Keeper Brandner constructed a cardboard duct that brought the cooled air directly to the Bushmaster enclosure and thus countered this problem. With much setting and resetting of controls it was possible now to keep the Bushmaster below the critical 70 degree mark. So with the makeshift duct for temperature and a hand-atomizer for providing moisture, the enclosure could (with considerable effort) be brought to the presumed proper conditions. When these preparations had been

taken, the Bushmaster was introduced to its new quarters and it settled down quietly in its hollow log in view of the public.

The problem of feeding was still unsolved. We did not know whether it refused most of the food offered because the usual white rat or mouse was too far from its normal diet, or for some other reason. It did accept an occasional food item, though, and after some months Brandner reported that he began to see a pattern emerging. Instead of taking food every week or every two weeks, as most snakes do, the Bushmaster accepted only about one small rat a month. Under its conditions of low temperature this proved to be sufficient to keep weight and growth at presumably normal levels. The keeper also noticed that there was a much greater tendency for the snake to feed if the cage had been sprayed just before the food was offered.

This was a promising lead: it implied that the Bushmaster might prefer to feed after a "rain." On one feeding day the cage was allowed to dry to below the 80 percent humidity that was normally maintained. In late afternoon it was soaked with a particularly heavy spraying and a freshly-killed rat was placed in the center of the floor. Next morning the rat was gone. Theory had become prediction. Since that first trial the Bushmaster has accepted such an offering regularly.

The previous record for Bushmaster-keeping in this Zoological Park — and other zoos as well — was passed in July but Brandner was far from satisfied. He has raised his sights now to the 16-month Trinidad record of Mr. Mole, or even the 20-month combination record of Prof. Urich and the old Reptile House. Unless some unexpected accident occurs (and this is always possible when a single individual is involved), such a record appears to be within reach. The kind of devotion to duty so well exemplified by Reptile Keeper Brandner, in combination with modern equipment and some knowledge of the basic requirements of an animal, is hard to beat. With a little luck, we hope to achieve a world's record for Bushmaster longevity in 1962.

* * *

On September 27, when this issue of *Animal Kingdom* went to press, the Bushmaster was still in good health and had been with us 14 months and 7 days.

News from the Conservation Foundation

New Textbook in Watershed Management

On August 31 the Conservation Foundation accepted a proposal submitted by Dr. Bernard Frank through the Colorado State University to support a two-year study for the preparation of a textbook in watershed management to serve students and instructors in colleges and universities which deal with one or another phase of the subject. The textbook is expected to find a ready market among public and private water resource engineers, forest, range and agricultural land managers, land and water economists and non-professional conservationists and their organizations. This textbook will be prepared by Bernard Frank (senior author), Professor of Watershed Management, and Robert E. Dils (co-author), Pack Professor of Watershed Management, both with the Cooperative Watershed Management Unit, College of Forestry and Range Management, Colorado State University. It will be the first definitive textbook in its field — a matter of great importance since watershed management is now recognized as a specialized field of natural resources comparable to wildlife management, range management and forest management.

Faculty Seminar on Natural Resources

The University of California at Berkeley has received a grant from The Conservation Foundation for the academic year 1961-62 in support of the Chancellor's Committee's sponsorship of a "Faculty Seminar on Natural Resources." The Committee, under the chairmanship of S. V. Wantrup, proposes a series of monthly faculty seminars to be held in the Faculty Club. These seminars will be organized around the broad theme of "quality versus quantity" in the use and management of natural resources. Topics will range from a discussion of this theme in the philosophy and methodology of science to an examination of concrete problems in the management of quality through public policies. Such examination will be directed especially toward water resources, soil, air and recreational resources.

Busy Conference Season

An unusually active summer of teachers' conferences has been serviced by the Foundation's Audio-Visual center in New York. Among those requesting teaching material, filmstrips and films, have been the National Conservation and Resource-Use Education Conference at Daytona Beach, Florida; the Institute for Secondary Biology Teachers sponsored by the National Science Foundation at Missoula, Montana; the Outdoor Education Workshops at Corvallis, Oregon, and the Social Studies Center conducted by the Sisters of the Immaculate Heart of Mary at Monroe, Michigan. Other conferences, as reported by Martha Munzer who was in personal attendance, included the Riverdale and Bear Mountain Outdoor Laboratories and the Conservation Education Association's annual meeting at Montana State University. Materials furnished represent part of the Foundation's work in stimulating resource education in the minds of teachers responsible for curriculum planning.

Briefly Noted

In addition to those already announced, Dr. Jean L. Baer, Sir Charles Darwin, Dr. Chikao Honda and Dr. Mahomedali C. Chagla have accepted The Conservation Foundation's invitation to contribute articles to its forthcoming population book . . . Wallace Bowman, assistant director of research, resigned on August 10 to accept a position as Resource Planner in the Governor's Division of State Planning, Alaskan State Government . . . A new member of the Research Department is Michael Gucovsky, research economist and graduate student in agricultural economics at the University of California, Berkeley . . . Frank Fraser Darling addressed a group of Commonwealth journalists at Oxford University on the subject of "Wildlife Problems in Africa" on August 17 . . . Roger Hale will represent the Foundation at the American Forestry Association's 86th Annual Meeting in Sante Fe, New Mexico, on October 1-4 .

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Africans Told of Society's Interest in Wildlife

The active interest of the Zoological Society in wildlife conservation in Africa was discussed with United Nations and Consular representatives of nine African countries at a luncheon at the Zoological Park on September 7.

Dr. Fairfield Osborn told the African officials of the conservation studies made by the Society in the Mara and Serengeti Plains and in the Sudan, research on the Mountain Gorilla in the Congo, and other projects now being conducted as a result of the African Wild Life Fund set up by the Society.

The group gave warm personal endorsements to a statement presented by Dr. Osborn: "We believe in the values of national parks and similar reserves within which the unique natural heritages of our country, and indeed of Africa as a whole, may be preserved for posterity."

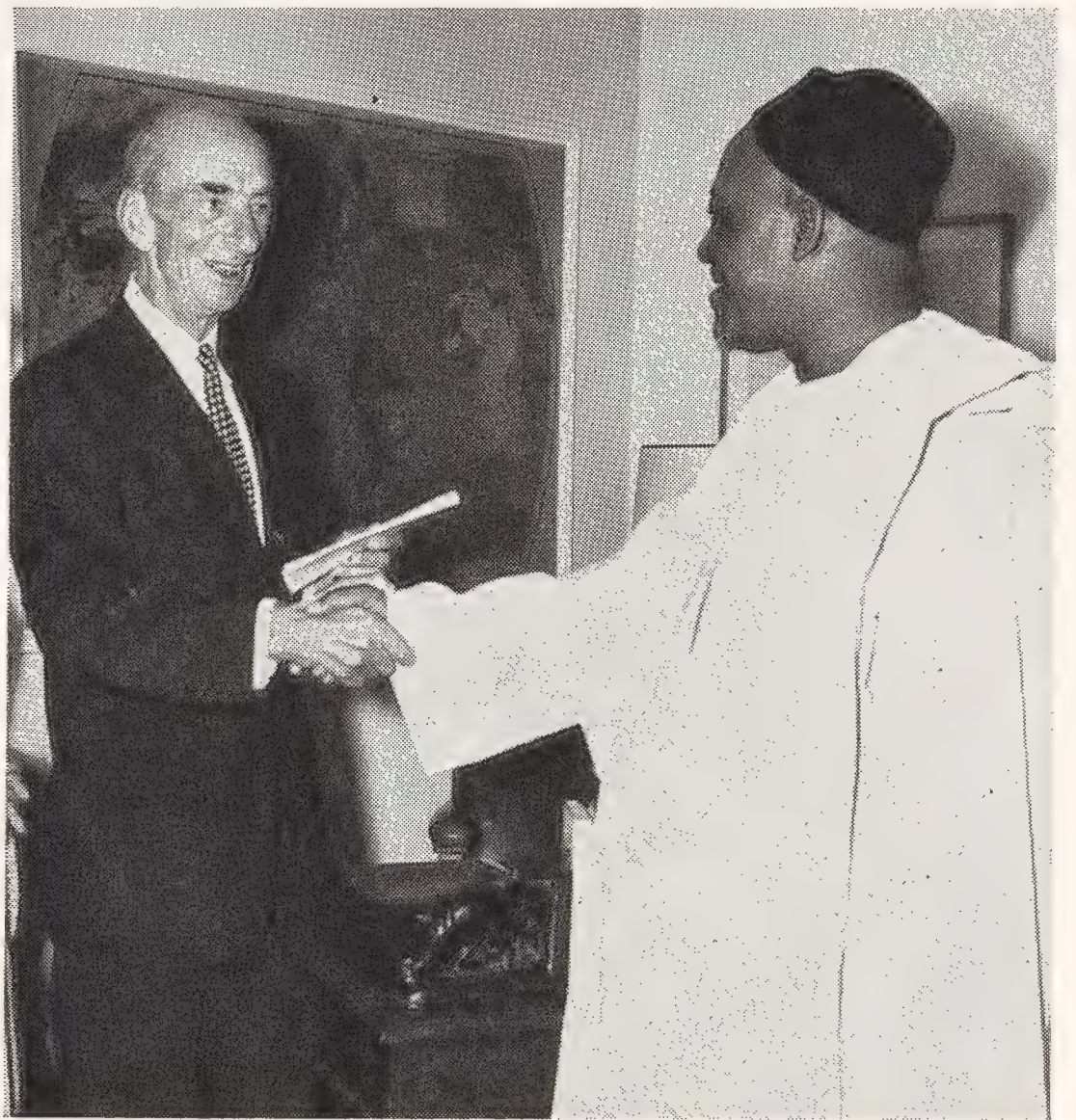
During a tour of the Zoological Park that followed the luncheon, several of the officials remarked that they had seen far more African animals in the Zoo than they had ever seen in their own countries, and that thousands of their citizens were equally unfamiliar with their native fauna, largely because it has disappeared or has been driven to remote areas.

United Nations personnel at the luncheon were M. Gervais Bahizi, Deputy Permanent Representative of the Congo (Leopoldville), H.E.M. Arsene Assouan Usher, Ambassador from the Ivory Coast; H.E. Christie W. Doe, Ambassador from Liberia; and H.E. Muhammad Ngileruma, Ambassador from Nigeria.

Consular representatives were present from Cameroun, Gabon, Ghana, Liberia, Madagascar, Nigeria and Sierra Leone.

* * *

Following publication of the booklet, "The Crisis Facing Wild Animals in Africa" in the May-June issue of *Animal Kingdom*, and its



U. N. Ambassador Ngileruma of Nigeria and Dr. Osborn had wildlife interests in common.

Photo Dept. Commerce & Public Events

wide distribution, many contributions to the African Wild Life Fund and letters of commendation for the Society's work in Africa have been received.

The Staff Travels

Dr. James W. Atz, Associate Curator of the Aquarium, represented the Society at the 10th Pacific Science Congress in Honolulu at the end of August . . . Dr. Herndon G. Dowling, Curator of Reptiles, was at the meetings of the American Institute of Biological Sciences at Purdue University August 27-31 . . . Dr. Ross F. Nigrelli, the Aquarium's Pathologist, is attending an international congress on protozoology in Prague and will visit aquariums in Norway, Monaco and France, and will work on Mediterranean invertebrates at the Naples Zoological Station . . . Dr. John Tee-Van is attending the meetings of the International Union of Directors of Zoological Gardens in Rome, and will visit several European zoos . . . Several members of the staff were at the

annual meetings of the American Association of Zoological Parks and Aquariums in Rochester at the end of September. Director William G. Conway gave a paper on the advantages of a Society in the operation of a zoological park, Associate Curator of Mammals Joseph A. Davis, Jr., talked to the group about the red light technique of exhibiting nocturnal mammals, and Lee S. Crandall, General Curator Emeritus, gave a report on his nearly completed book on the care and management of wild mammals in zoological gardens. Mr. Conway has been elected a director of the A.A.Z.P.A. . . . Dr. Charles P. Gandall, the Zoo's Veterinarian, attended the American Veterinary Medical Association meeting in Detroit and was re-elected President of the American Association of Zoo Veterinarians.

Photographs Win Awards

Photographs by Staff Photographer Sam Dunton won first and second awards in the annual exhibition of the Biological Photographic Association in Chicago August 21-24. Four other photographs by Mr. Dunton were accepted for hanging. First place went to an underwater picture of a Puffin, made at the Zoological Park, and second place to a photograph of a Mediterranean Sea Anemone made at the Aquarium. Mr. Dunton was elected as a Director of the B.P.A. for a term of three years.

IN BRIEF

Red Light Room. The new Day-into-Night exhibit employing red fluorescent light to induce nocturnal mammals to be active by day, which forms the "Red Light Room" in the Small Mammal House, was opened to the public on September 15. Members of the Zoological Society saw a preview at the Garden Party on the previous day.

Botulism Strikes. An outbreak of botulism occurred on the Wildfowl Pond and the Marsh Garden in August and the Zoo's fine collection of waterfowl, 99 species, was hard hit. Nearly 100 birds died, including some of the rarest and most costly specimens. Extremely hot weather and sudden rains are often followed by botulism, but the focus of infection has not been determined despite constant patrolling of the margins of the

water areas. The hot August weather created the same kind of conditions along the Bronx River and many wild ducks were killed. Botulism outbreaks are a scourge of waterfowl populations in some wilderness areas.

Snakebite. Head Keeper Stephen Spencook of the Reptile Department was bitten by a Cottonmouth Moccasin on August 8 while he was removing surplus food from a compartment containing the Moccasin and a Copperhead. One fang penetrated the heel of his right hand but prompt application of emergency first aid procedures and injection of antivenin saved him from permanent injury. He was able to return to work within a week. This was the first snakebite in the Zoological Park since 1937.

Talking Storybooks. To supplement the printed labels on each animal exhibit, an audio device called "Talking Storybooks" has been installed in 40 locations throughout the Zoological Park. It was put into operation on September 23. The device is a tape playback machine, actuated by a key inserted in a box at each location. Talks lasting a minute to a minute and a half are heard when the key is inserted, and the same key — which visitors may buy for 50 cents — actuates the boxes all over the Zoo. Keys are retained by the visitors and may be used at any future time. The device was installed by Audio Tours, Inc., of San Francisco.

PUBLICATIONS OF INTEREST

BIRDS IN MY INDIAN GARDEN. By the Rt. Hon. Malcolm MacDonald. 192 pp., 98 photographs in black and white and frontispiece in color, by Christina Loke. Alfred A. Knopf, N. Y., 1961. Price \$11.45.

At first glance, this handsome volume appears to be simply a charming account of familiar Indian birds in a Delhi garden and its environs and as such, it will give much pleasure to the great host of American "bird watchers." The author was able to practice his favorite avocation only at odd moments while High Commissioner for the United Kingdom in India from 1955 to 1960, but he has written of his experiences with charm and insight. Actually, the latter ability has carried him far beyond mere "watching," for he has been able to record many observations of real value. The full-page reproduction of Mrs. Loke's excellent photographs add much to this really attractive volume. A list of species mentioned, with English, technical and Indian names, will be found most helpful. Among other things, it will assure the reader that Mr. MacDonald's "Blue Jay" is really *Coracias banghalensis*, the Indian Roller, and not the familiar inhabitant of American gardens. — L. S. C.

INSECT LIFE AND INSECT NATURAL HISTORY. By S. W. Frost. 526 pp., 406 illus. Second Revised Edition. Dover Publications, New York. \$2.25.

A paperback revised edition of the book "General Entomology" by the emeritus professor of entomology of Pennsylvania State University. Originally intended as a textbook, it covers a vast amount of information about insect life and natural history of interest to the general reader.

DINOSAURS. Their Discovery and Their World. By Edwin H. Colbert. 300 pp., 100 plates, 51 text-figs. Dutton & Co., New York, 1961. \$7.50.

Books about dinosaurs tend to be very popular or very technical; here is one that is happily in between. Anyone who knows nothing about dinosaurs, but is generally interested, can read this book by the Curator of Vertebrate Paleontology at the American Museum of Natural History with enjoyment and profit. Recognizing that his is a hard subject for the layman, Dr. Colbert approaches it gradually and, in recounting the early days of the science, and especially the discoveries of the first dinosaurs, is delightfully anecdotal. The writing is free and easy throughout, the illustrations generously plentiful.

THE CILIATED PROTOZOA. By John O. Corliss. 22 plates. 310 pp. Pergamon Press, New York. International Series of Monographs on Pure and Applied Biology. Division: Zoology. Volume 7. 1961. \$12.00.

The monograph is an outstanding contribution on the characterization and re-classification of the Class Ciliata, a heterogenous and complex group of unicellular animals. This difficult subject was last attempted more than 25 years ago by Alfred Kahl and before that in 1899 by Otto Bütschli. The monograph is enhanced considerably by the inclusion of 95 pages of references on the Ciliophora, which should make the Protozoologist very happy. — R. F. N.

The Natural History Library

Thirteen books on various phases of natural history have just been published in paperback form as a result of a cooperative arrangement between Doubleday & Company and the American Museum of Natural History. In the public domain for the most part, they are "books of enduring interest in the life and earth sciences," whose selection was guided by a board of Museum staff members. Various staff members have written prefaces to this edition.

Books in the series are:

\$1.45

Horses. By George Gaylord Simpson.

John and William Bartram's America. Edited by Helene Gere Cruickshank.

The Pacific Islands. By Douglas L. Oliver. (Revised).

John Burroughs' America. Edited by Farida A. Wiley.

The Ocean Island (Inagua). By Gilbert C. Klingel.

From Fish to Philosopher. By Homer W. Smith.

White Waters and Black. By Gordon MacCreagh.

Modern Science and the Nature of Life. By William S. Beck.

\$1.25

Shearwaters. By R. M. Lockley.

The Mountains of California. By John Muir.

95¢

The Exploration of the Colorado River. By John Wesley Powell.

The Wandering Albatross. By William Jameson.

Dwellers in Darkness. By S. H. Skaife.

All of the volumes are more or less elaborately illustrated. The printing is clear and sharp and the type large enough to be read easily.

New Members of the New York Zoological Society

(Between July 1 and August 31, 1961)

Benefactor

David H. McAlpin

Fellow

Dr. William Antopol

Life

Fred L. Rosenstiel

Supporting

Stevenson Burke

Contributing

Mrs. Ruth B. Avery

Mrs. Gertrude Blecher

John A. Bradley

Louis Britwitz

Ralph M. Carson

Dr. Joseph Davis

H. C. Dienst, Jr.

John B. Ensign

Charles D. Gamble

Mrs. Kenneth H. Granger

Randolph Guggenheimer

Mrs. Lytle Hull

Mrs. Gilbert B. Lamb

Warren Landman

George Murnane, Jr.

Miss Esther Pearson

Mrs. Samuel Resnick

Miss Ruth Richards

Mrs. Betty Spangenberg

Dr. Carl Fulton Sulzberger

Mrs. Frederick D. Thompson

Jacob J. Ulman

Mrs. Mary E. Vence

Miss Henrietta V. Vogt

Annual

Rev. Thomas J. Bigham

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Joseph Brew

William V. Burokas

Mrs. George Cook, III

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Louis A. Ferry

Daniel Friedman

Mrs. Randall Fulton

Alan R. Geist

Richard G. Green

Henry D. Hammond

Harvey L. Hartman

Mrs. Harl A. Hockeborn

Miss Stephanie E. King

Ben Korn

Ludwig L. Maas

Robert R. Maller

Ralf H. Masure

Mrs. Drummond F. Maxwell

Michael Vincent McEvoy

Morris Miller

Leo B. Oaklander

Miss Amy Stuart Roe

Dan Samuels

Harry Silverstein

Todd Strasser

Mrs. Edith M. Tucker

Herbert S. Wilkes

Donald Wilson

The Best Show in Town

The best "Off Boardwalk" show in town right now is at the Aquarium at Coney Island. This time, Producer Fairfield Osborn and Director Christopher Coates have fairly outdone themselves.

The principals include Ookie, about the most engaging Walrus ever; her overeager fiancé Olaf, the biggest Walrus in any Aquarium anywhere; Beluga Whales from far-off Bristol Bay in Alaska, grayish-white now and soon to become as white as a laundered shirt; 3 friendly-as-puppies baby Walruses from the Arctic; a couple of rare and charming Ringed Seals, with eyes as big as saucers and bellies as fat as bowls; and assorted Harbor Seals and Gray Seals.

The show is beautifully staged in the big renovated Oceanic Tank and the adjoining Tri-pools. Thanks to the Aquarium's new seawater wells and the crystal clear water delivered by the new filtration system, visibility is excellent to superlative. There's a particular thrill in looking into a Beluga's eye through an underwater window — a thrill that defies description.

Showmen Osborn & Coates talk of expansion, of the new Walrus Complex, of more expeditions to Alaska and of more fishing trips to the tropics. But they don't need to.

They've got the best "Off Boardwalk" show in town right now.

MEMBERS!

It's easy to get to the Aquarium:

By Automobile: Take Shore Parkway in Brooklyn to exit marked Ocean Parkway Coney Island; go south on Ocean Parkway, then curve right on Surf Avenue to the Aquarium. Parking lot at Surf Avenue and West 8th Street.

By Subway: IND "D" train to West 8th Street, Coney Island.
BMT Sea Beach: Change at Stillwell Avenue to Brighton Local or IND "D" train. Get off at West 8th Street, Coney Island.

BMT West End: Change at Stillwell Avenue to Brighton Local or IND "D" train. Get off at West 8th Street, Coney Island.

BMT Brighton Local: To West 8th Street, Coney Island.

Plan a trip there* soon — and bring a potential Society Member with you.

* From now until Spring, open 10 a.m.-5 p.m. except on Mondays and Tuesdays.



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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

ANIMAL KINGDOM

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New York
Zoological Society

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Trusteeship for Animals

A YEAR COMES TOWARD ITS END — another year. Man will make the turning of the year an occasion for review of the one just past and making plans for the new year about to be born. Our lives are measured by months, by weeks and by days — minutes, too, must be accounted for — occasionally even by insistent flashing signs atop high buildings in great cities. Man alone has the capacity to look back into the past and to peer into the future.

Animals are incapable of using time as a yardstick for planning in this way, although despite this they have evolved and flourished over millennia of time. The pattern of their lives is expressed in a poem from the Sanskrit:

“Look to this Day!

“For it is Life, the very Life of Life.”

Consequently, all animal life on this earth, indeed all natural living things, are at the mercy of the planner, the builder and destroyer — man himself. The great hope is that within his plans and visions for the future, man will make sure to be the guardian of the natural world around him. If he fails to do this, the richness of the earth will eventually disappear and man might as well move to the moon or some other sterile planet.

Fairfield Osborn

THE COVER PICTURE

This magnificent Reindeer buck came to the collection in February, 1957, as a young adult animal, and its antlers have been increasing in size each year. Now they are nearly at their peak. This photograph was taken late this fall while the animal was losing its velvet, shreds of which are still clinging to the hardening antlers.



Three of Them!

WHITE WHALES FOR THE AQUARIUM

By CARLETON RAY

Associate Curator, New York Aquarium

Photographs by W. ROBERT MOORE

National Geographic Magazine

AT THE NORTHEASTERN ROOT of the Alaska Peninsula, the Kvichak River flows into Kvichak Bay, which in turn merges with the vast expanse of Bristol Bay. At the mouth of the Kvichak there is a jumble of geography with such names as Dead Man's Flats, Copenhagen Creek and Half Moon Bay, and there, at certain seasons, the white whales known as belugas come to feed in the muddy shallows. They are vulnerable to capture when they are in the shallows on a falling tide and that is why the New York Aquarium sent an expedition to Alaska this August. We wanted white whales for our Oceanic Tank. We got them, too; three of them.

"Beluga" is a Russian word meaning "whitish" and it is apt, for adults are ivory white over the whole body except for brown eyes and grayish

edges to the fins. Bulls may be 16 feet long, cows a foot or two shorter. Calves are born in the spring or early summer and are 5 to 6 feet long, dark gray in color; they become progressively lighter and are white by the time they are 10 to 12 feet long. Scientifically, belugas are called *Delphinapterus leucas* and their nearest relative is the "unicorn of the sea," the Narwhal, *Monodon monocerus*.

The expedition left New York by air on August 5: Charlie Young, senior tankman of the Aquarium; W. Robert Moore, chief of the foreign editorial staff of the *National Geographic Magazine* (who was to cover the capture in still photog-

raphy) and myself. The next day Seward Johnson, a Life Member of the Zoological Society, joined us in Anchorage. His job was to take motion pictures. (The Zoological Society will see them at the mid-winter Members' Meeting).

On a trip such as this you try to think of everything you need and take it with you, for while a great many articles can be purchased in Alaska as readily as in New York . . . still, the articles likely to be required for the capture, care and transportation of white whales are not stocked everywhere. We took four thick, foam-rubber mattresses, foam-rubber pillows, waterproof covers for them, a 40 H.P. outboard motor, oversized, reinforced hospital stretchers, 25 yards of cotton muslin to cover the whales and keep them wet when they were out of water — and a more usual miscellany including antibiotics and vitamins, camp stove, sleeping bags and food.

For some days prior to our departure a series

White whales really are white! However, the three in the Aquarium are not quite as white, yet, as this one appears to be. Still "off-white," they will attain a more clear whiteness two to three years hence.

of telephone calls had been made between New York and Alaska and we were in close contact with James Brooks of the Alaska Department of Fish and Game. His department approved of our venture and with typical and unfailing Alaskan cooperativeness had undertaken to find Charlie Wilson for us — Charlie Wilson, a fast man in a motorboat and an expert herder of white whales. He is the best small boatman I ever saw. He can stand in the stern of a small skiff going full speed and turn on a dime, almost never losing track of a tricky whale, and then throw a 300-foot salmon net around the animal. All at full speed.

On the morning of August 9 we all met at Naknek on the shore of Kvichak Bay — the four of us from the east, Charlie Wilson and Alex Tallekpalek, the latter with his 22-foot skiff that would come in handy for transporting whales rounded up by Charlie's faster 16-foot skiff. We crossed the Kvichak in Charlie's 32-foot salmon boat, the *Ann*. It was a pleasant day on the Kvichak. Jaegers and terns and gulls soared in a sky that was at least a third blue, into a ten-mile wind, and a light rain that fell from the spotty

cumulus cover. By mid-afternoon we pulled into Copenhagen Creek and began to unload gear. Charlie Young sank into mud to his knees, Seward Johnson almost disappeared from sight, and Bob Moore had to be unstuck a couple of times. It was not our last encounter with Alaskan mud before the expedition was over.

The cabin on the tidal flats that was to be our home for an indefinite number of days was in pretty good shape; there was rot in the corner that hung over a bank that the tide had washed away a few years ago. But the 1958 tarpaulin was still on the roof.

We settled in and studied the tide tables. Belugas are governed largely by the tides, ascending the river in the deeper channels on the flow and feeding in the creeks and the river itself as they travel. On the ebb they usually follow closer to shore downstream, still feeding or just travelling leisurely. The ebb is the time to catch them, for it is then that they are more likely to be near the flats where they can be driven into shallow water and netted.

At about half-ebb, the belugas are usually in the vicinity of Half Moon Bay, where the flats are a couple of miles wide with water scarcely changing in depths over wide expanses. At low tide they are 15 miles south on Dead Man's Flats. At Copenhagen Creek the tide varies from 13 to 25 or more feet and flows in the channels at 6 to 10 miles an hour. Beluga-hunting is, therefore, a pre-determined affair, depending on the tides.

And there is one other compelling factor: the wind. We could hunt in cold and rain, clear skies or cloudy, but not in wind. A chop of less than six inches makes it impossible to follow a whale's wake in this murky water.

The next few days were discouraging. There were few whales in the river, a dozen or two at most, and the wind rose with the sun and tide. But we did try. A typical experience was chasing a 9-foot whale one morning in only four feet of water. Usually, by keeping on the deepwater side of the animal and revving the motor occasionally, you can turn it into the shallows — into 4-foot depths, or 3-foot, or even less. As the whale rushes for deeper water you keep the motorboat outside and ahead of it. On this particular morning we had perfect calm and the wake of the



The real start of the expedition came when the "Ann" was unloaded on the mud flats a couple of hundred yards from the cabin.

The expedition's camp was at this cabin on Copenhagen Creek. Dr. Ray can be seen on the roof, attempting to spot whales through binoculars. The tide comes to the grassy flats.



Left — Seward Johnson and Alex Tallekpalek got stuck in the mud while handling the boat. Below — Skiffs were stranded by the tide, for it rises or falls up to a foot every 18 minutes.



whale was easily followed, but for some reason it would not enter less than four or five feet of water. Finally, showing no particular fear, it reversed itself with typical beluga maneuverability, left us stalled, dived under the skiff, and simply disappeared.

Then came a gray and dreary day with an 8-10-mile northeast wind — a good beluga day, nevertheless. Alex woke at 4 a.m. and danced a jig around the cabin, chanting "We'll catch one today!" At Dead Man's Flats at 9 a.m. not a whale was to be seen, but at Half Moon Bay on the way back we spotted a small group. A gray whale was in the midst of it — just the size of youngster we wanted.

It took Charlie Wilson half an hour to ease the animal into three feet of water and to position himself for the throw of the net. The net went out smoothly and almost immediately the whale rolled into it. Quickly and as gently as possible we noosed it, despite its objections; it threw me more than once and drenched Charlie Young when he jumped into the water, clothes and all, to help. The larger skiff was brought up with mattresses arranged on its bottom, we slipped a board under the whale, lifted, and slid the animal into the skiff. In half an hour it had calmed down almost completely and by that time we were back on the beach in front of the freshwater holding pond where our captives would be kept until we had three or four and were ready to leave.

This was a beautiful animal, a female 9 feet 4 inches in length, about 800 pounds and just turning white on the "melon," the raised bump on the snout. Unfortunately when we reached the beach it was almost dead low tide and there were 300 yards of sand and mud, all uphill, between us and the pond. We dared not wait for the tide to turn and float the whale part of the way. So Charlie Wilson and Alex improvised a sled and padded it with a foam mattress. The whale was lugged onto this and covered with wet muslin and by pulling, all of us, with all our strength, we dragged that whale to the pond. A gain of 25 to 50 feet was all we could register at a time, and it took an exhausting hour, but we made it. Afterwards we collapsed on the tundra.

Now the critical phase of the expedition had

begun. As long as "Charlie" (as we had nicknamed her) remained in the freshwater pond, she would necessarily have to go without food, and would become weaker. We had to catch a couple more quickly, for we did not want to go home with only one. Belugas are sociable animals and three are far more than three times as safe as one.

For the next seven days we didn't have a chance. The weather was "wind with occasional calm," and the wind varied from 10 to 40 miles an hour. The Kvichak was impossibly rough but "Charlie" was doing well in the pond.

Sunday, August 20, was a day of reprovisioning. Seward and I flew to King Salmon and a surprise awaited us at the airport; the B-17 plane from New York that was going to carry our captures home was waiting for us, despite an earlier telegram asking it to wait until we had caught our whales! But on second thought, the situation wasn't too bad. True, we had only one whale, but we had the B-17 crew of four as extra helpers if we needed them.

That night I queried Charlie Wilson.

"Where do you think they are, Charlie? Maybe following the salmon in Nushagak Bay, on the other side? How about chartering Guy Groat's plane and scouting them out?"

"I guess we could" was as far as Charlie would go, so we walked down to the *Ann* and got Guy on the radio.

Next day we flew the bays. There were only a dozen whales in Kvichak and perhaps twice that many in Nushagak. Not good at all, and still the wind. If whales were seals, we would have been in good shape, though. There were several hundred on the east bank of the Nushagak.

Tuesday: wind and rain. Wednesday: a wind shift to the north, a blue-black sky at night and a brilliant moon. At 11:20 o'clock on Thursday morning we saw a big school heading past the creek downstream.

"Fifteen minutes, then let's go," I said, gulping the noonday soup.

Then Charlie made a deal. "Give me the kicker if we catch two today?" he said.

It didn't take me long to agree to what I thought was an impossibility — to capture two whales in one day. The outboard motor would be a cheap price to pay for such luck.

"It's a bet."

We tore out of the creek for Half Moon Bay and just beyond the creek Charlie spotted a wary "floater," a gray two-year-old. He followed it to the north end of the bay and quickly eased it into three feet of water. The net ran out and the whale was inside. Just then Guy Groat's float plane loomed up carrying Karl Keller of the B-17 crew — welcome aid in the job of dragging our capture to the holding pond. It was a fat, 9-foot 2-inch female, about 800 pounds, nicknamed "Bertha III" for identification. Although the tide was only two-thirds out and our haul up the beach was only 200 yards, and we had a total of eight men to help, I still wonder how we did it in an hour the first time.

Such a lucky quick capture took the edge off our desire for another battle, but Guy brought word that there were still whales in the bay. He offered to spot them for us with his plane. Alaskans have a hard time not being helpful.

The adrenalin flowed again, plane and skiffs headed south. Guy flew 15 miles to Dead Man's Flats and circled tightly. Then it happened.

Before our eyes the big school appeared. The late afternoon sun reflected on sky and water to blend them into luminescent blue-gray at the horizon. Against this shimmering backdrop, as if suspended in space, appeared the gleaming white backs and puffy spouts of the belugas. There could have been a hundred in the whole herd. In no time, it seemed, we were at Dead Man's Flats and had overtaken a 12-foot cow and her yearling calf.

They were a close pair, refusing to separate yet making only a few furtive attempts to escape into deeper water. The sea was glassy and following their combined wakes was no problem. They soon were in two and a half feet of water, swimming at the same slow speed and breaching at the same instant. There was nothing to do but throw the net around them both.

The cow immediately hit the net and dragged a fifty-foot pocket with her. I leaped into the water and went for her. Making my grab for her tail with the noose, she slapped me on the head and shoulder and left side with a pair of flukes almost three feet across. The blow threw me backward into the water.

Charlie Wilson and Charlie Young were in the skiff, drawing the ends of the net together,



Top — Chasing a whale, seen at the left of the boat. The 300-ft. salmon net will soon be cast out. Center — Now comes the job of getting the whale out of the net. Its mother has drawn out a pocket in the net, upward and to the right. Bottom — Dr. Ray has a strap around the whale's tail and holds it in the shallow water.

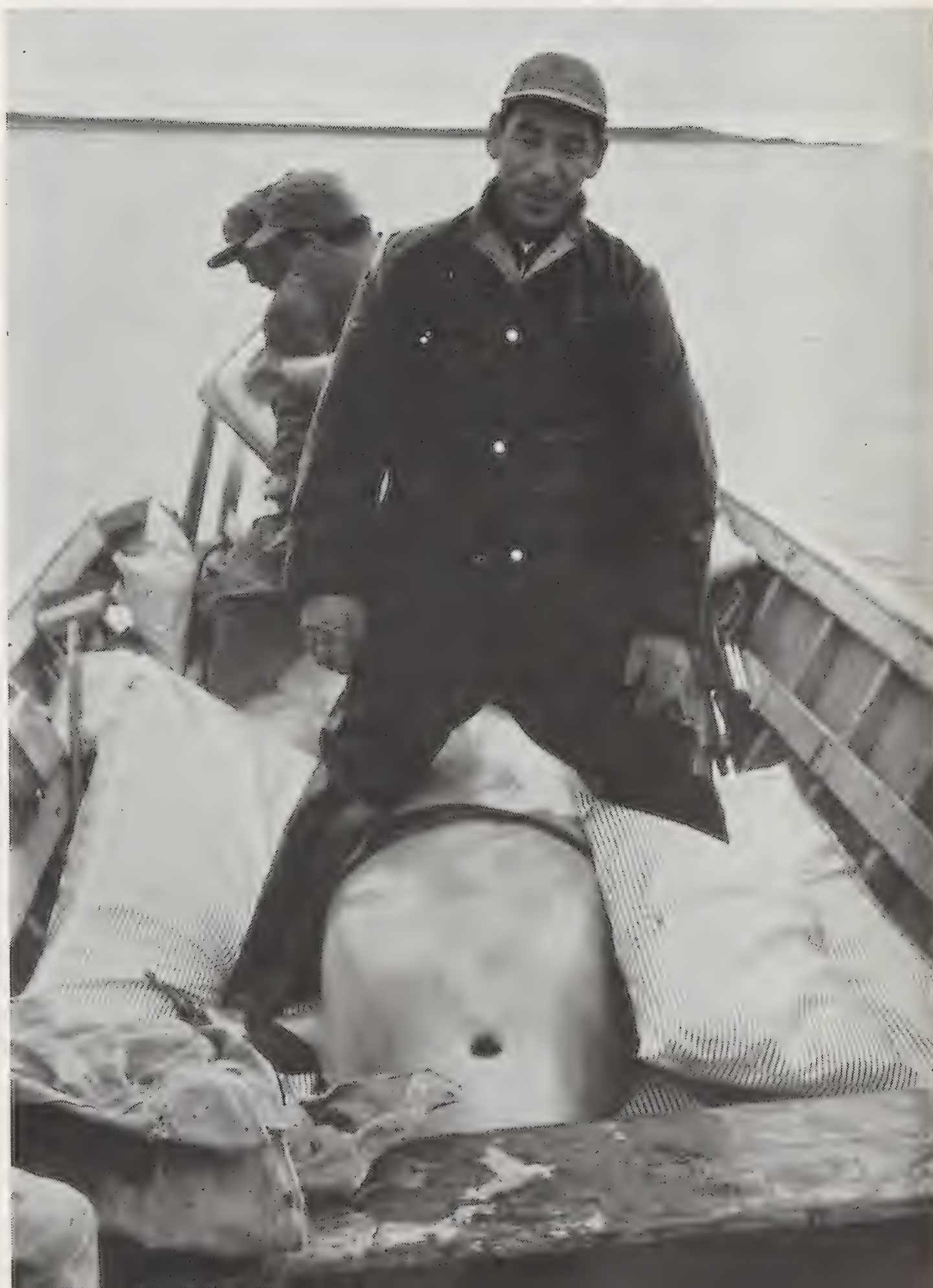


Above — Wet muslin is spread over the whale on the way to the holding pond. It rests on foam-rubber mattresses. Right — Charlie Wilson was proud of the whale named “Charlie.”

and I abandoned the cow and went for the calf. At first its sonar functioned perfectly and it always avoided the net, approaching within six feet and then turning sharply. But as I pressed it closely it hit the webbing and rolled. We had it. It was a male, 7 feet 3 inches long, about 450 pounds and very fat, active and vocal.

With comparative ease we hoisted it into Alex's skiff where it began to make an amazing variety of noises — flatulent puffs, creaky to mellow whistles, high squeaks and squeals. We named it “Alex.”

There was still the problem of the big cow, who must have weighed 1,600 pounds. We knew it was hopeless to try to carry her, but we had to make the attempt. We noosed her and made two futile attempts to hoist her into the skiff, but in the end we had to give up. We released her and she swam off in 18 inches of water. It was just as well. The tide was going out and we





Above — Attempting to load a 1,600-lb. female beluga. The method is to slide it on a board, then try to lift the board while pulling on the straps. This board broke and the whale was liberated. Below — an improvised sled was used to haul “Charlie” some 300 yards from the water’s edge to the holding pond. The animal weighed 800 pounds and it was a hard chore.





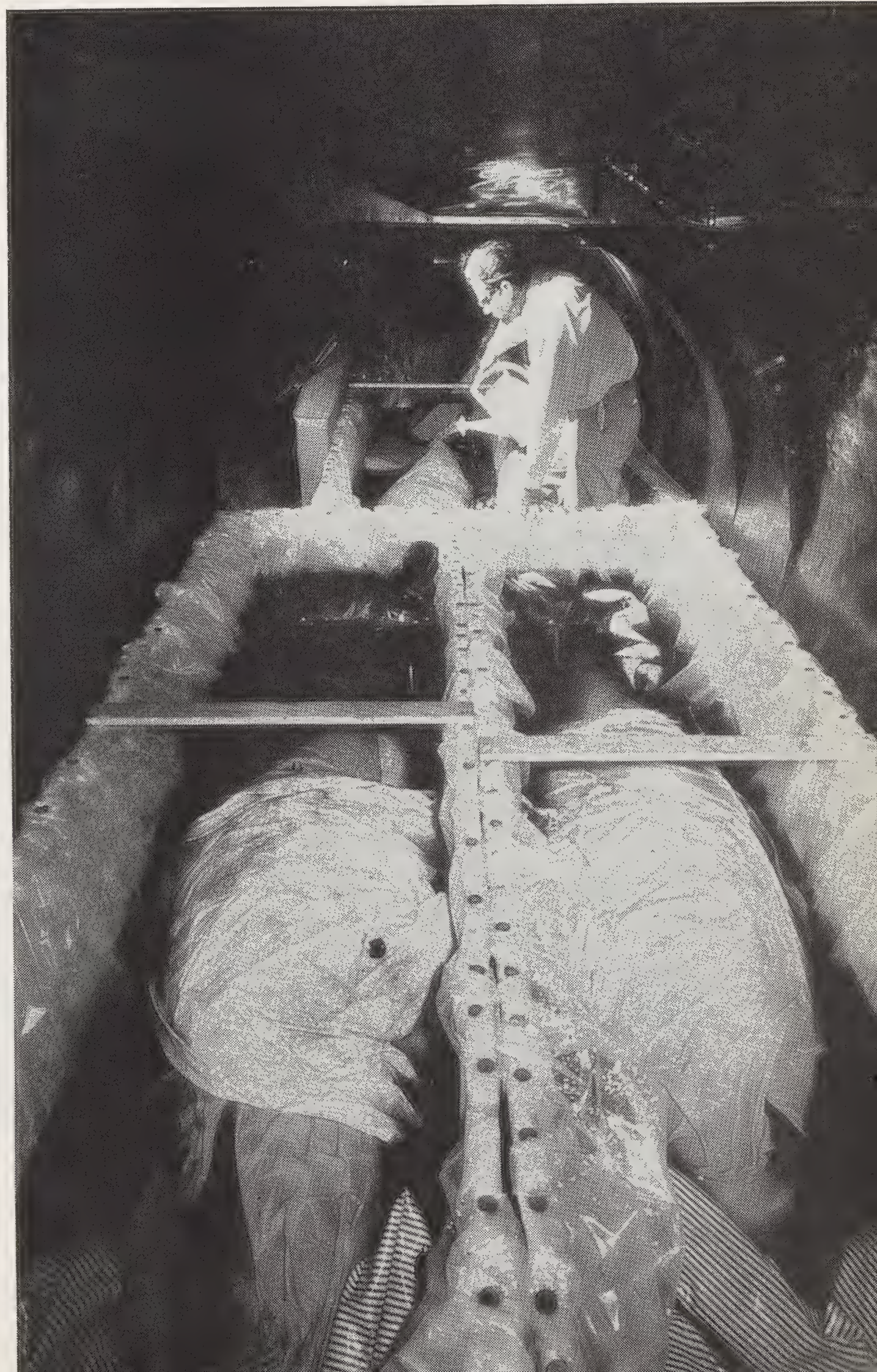
Above — Loading “Alex” was tricky, for the weather turned bad and the boards broke. Right — But everything came out all right. All three whales are in the B-17, ready to depart.

scraped bottom on Dead Man’s Flats several times on the way home. By 5 o’clock that evening all three belugas were swimming close together, counter-clockwise, in the holding pond.

We would have liked to have four whales and we made another attempt the next day without success. Well, three would crowd the B-17 anyway.

Saturday, August 26, was loading time, prefaced by the recapture in the pond. It was a matter — and not an easy or quick one — of seining for them, strapping them, laying them on their stretchers, and then sledding them to a spot on the beach where we thought the *Ann* would be at half tide. On the beach they were laid on mattresses and covered with wet muslin while Charlie Wilson brought the *Ann* closer with the tide.

Loading was a nightmare. A 2-by-12 plank cracked under the weight of loading little “Alex” onto the *Ann* and we knew we could never lift the 800-pounders up five feet while standing in



the mud. There was only one thing to do; load the two heavy females into Alex's skiff one at a time and then transload into the *Ann* across a slightly inclined plank bridge.

If we ever do it again, I shall call on the entire population of King Salmon to help. Maneuvering the boats left only four of us to lift those whales. We did it in an hour and a half, and I still don't really know how.

Under deteriorating weather we rode a rising sea to King Salmon and its large airfield. I do believe the entire town was waiting. As usual, the Alaska Department of Fish and Game pitched in, one and all. Dean Paddock and Frank Lockard had their truck lined up to carry the whales to the airfield and the local people helped so that the unloading was only a fifteen-minute task. Charlie Wilson and Alex pulled out as soon as the whales were transferred.

"I'll have the motor ready for the next time," Charlie told me, grinning. That night they would be back in Copenhagen Creek and the day after in Levelock preparing for the fall and winter hunting and trapping.

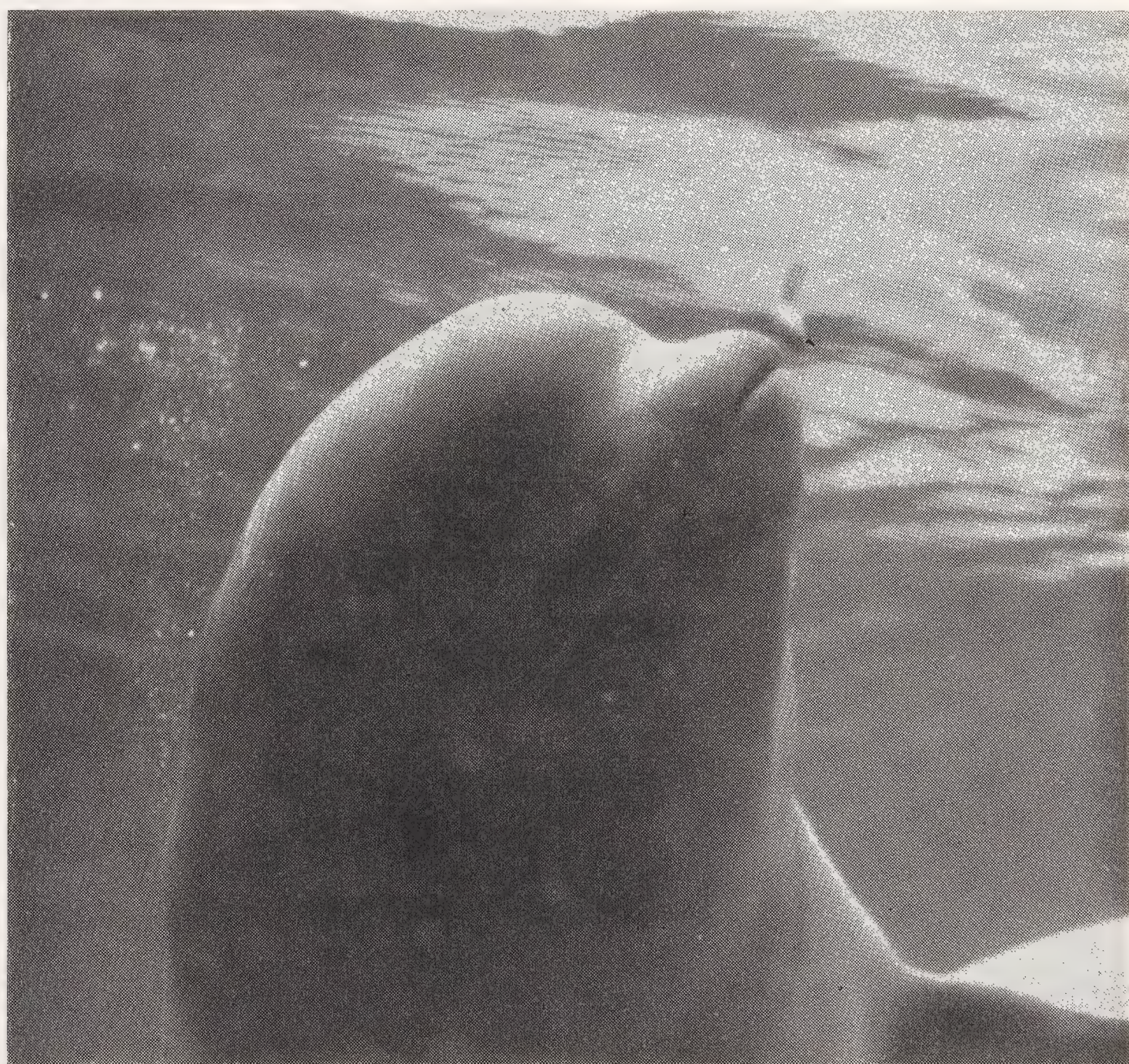
Aboard the plane the whales' boxes were filled with water to immerse half to two-thirds of their bodies, so that only part of their weight pressed down. At 4:30 we were off, 24 hours' flying time from New York.

At 1 a.m. on August 28 the three whales were swimming in the Aquarium's Oceanic Tank.

* * *

That is the story, except to say that we have gotten over the highest hurdle, that of getting the whales to eat. They did not do so for the first week, despite chewing incessantly on all the fish that were offered to them. Then we administered heavy doses of crude liver extract, rich in vitamins, and the next day they all fed heavily. They were not, of course, in the seclusion that would have been best for them. They had to become accustomed to clear water, to glass walls, to the noise of people and aircraft and, worst of all, to the construction still going on in the filter next to their tank. The noise visibly frightened them. But they came through admirably and two months after arrival began taking frozen killifish from the hand. They each consume more than 30 pounds of killifish a day plus large vitamin doses and we are confident that they will soon accept the more nourishing mackerel which we offer to them. Then we will begin training them in a show that will be a bit different from that of the usual oceanarium: a demonstration of their remarkable sonar ability. Along with it will go a program of research, for these are in many ways the most remarkable of the smaller cetaceans and there are many things to be learned.

Three-inch-long killifish are staples of the whales' diet in the Aquarium, but we hope to get them onto large food soon.



HOW OLD ARE THEY AND HOW BIG DO THEY GROW?

By HERNDON G. DOWLING

Curator of Reptiles

PROBABLY the commonest questions about reptiles that we hear in the Bronx Zoo's Reptile House are: "Are they alive?", "How old are they?" and "How big do they grow?" Unfortunately these latter two are extremely difficult questions to answer — with accuracy — and the questioner too often has to go away with his curiosity unsatisfied.

While our inability to answer such apparently simple questions about reptiles may seem strange to the uninitiated, a little background shows the reason for it. First, in regard to age: reptiles do not display the symptoms of age that we look for in mammals; they do not get flabby, wrinkled or obviously infirm. Though their growth slows down in later life, it apparently never ceases completely. Thus it takes a complete history of the animal from birth for us to know about its age. A few field studies have been made in the United States and elsewhere that give some information about the life span of some of the smaller and shorter-lived lizards and snakes, but none has yet been made of any of the longer-lived kinds. Under captive conditions, too, this information is difficult to obtain. Unless the animal was born

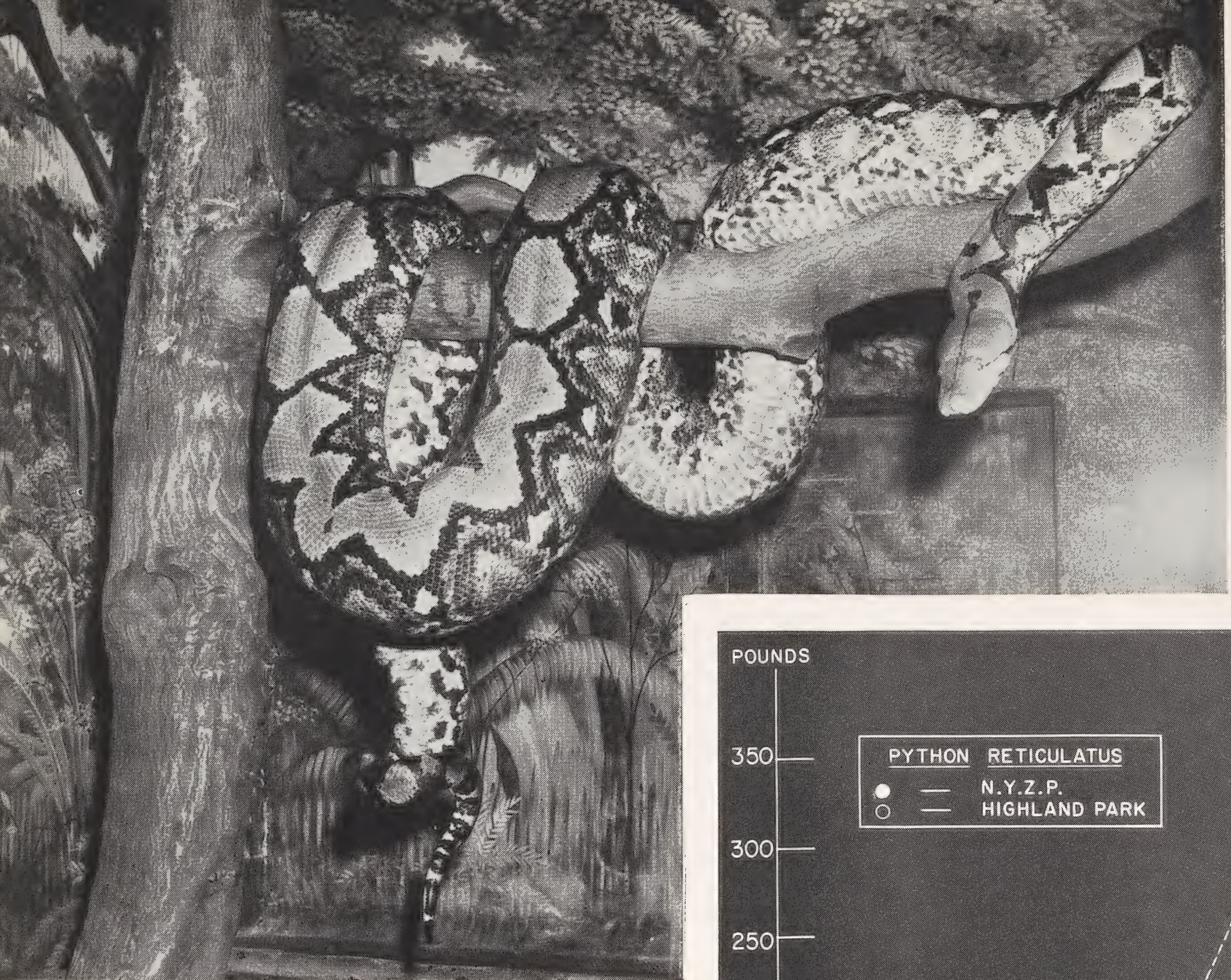
here at the Zoological Park or arrived here at an obviously early age, we can seldom give even an approximate life span.

In earlier days when ideas on rates of growth in reptiles was based on information from the poorly equipped and poorly heated reptile houses of that time, it was believed that all growth was very slow and thus that any large reptile must be extremely ancient. More recent studies have shown this to be completely untrue. An alligator may be mature in eight years and a giant tortoise may weigh over a hundred pounds in less than this time — if given proper conditions. Even so, information on maturity and early growth rates is still a long way from maximum ages and maximum sizes and we still have almost no information on these latter items.

This information is particularly difficult to obtain on the giant snakes. Tropical in distribution and long-lived in captivity, they still lack the field studies that might give us some idea of growth in nature. Probably such studies will never be made, because of the difficulties of capturing, marking, measuring and recapturing such animals. As a secondary choice, then, we must turn to studies of their growth under captive conditions. We hope that the growth rates under good zoo conditions are similar to those in nature; already field studies have corroborated such observations on crocodilians and we believe that our giant snakes are kept even more nearly under natural conditions.

Giant snakes have been kept in zoological parks for many decades and it seems strange that the information on growth is still so scanty. However, the difficulties of obtaining accurate lengths and weights, added to the difficulties of keeping accurate records, are a partial answer. No one who has attempted to obtain an accurate measurement of a large snake will underrate the difficulties involved! Probably, too, many records are hidden among the notes of curators and reptile keepers. It seldom seems necessary to publish such information until a great deal of it has accumulated — and accumulation is exceedingly slow.

However, two recent papers on growth in giant

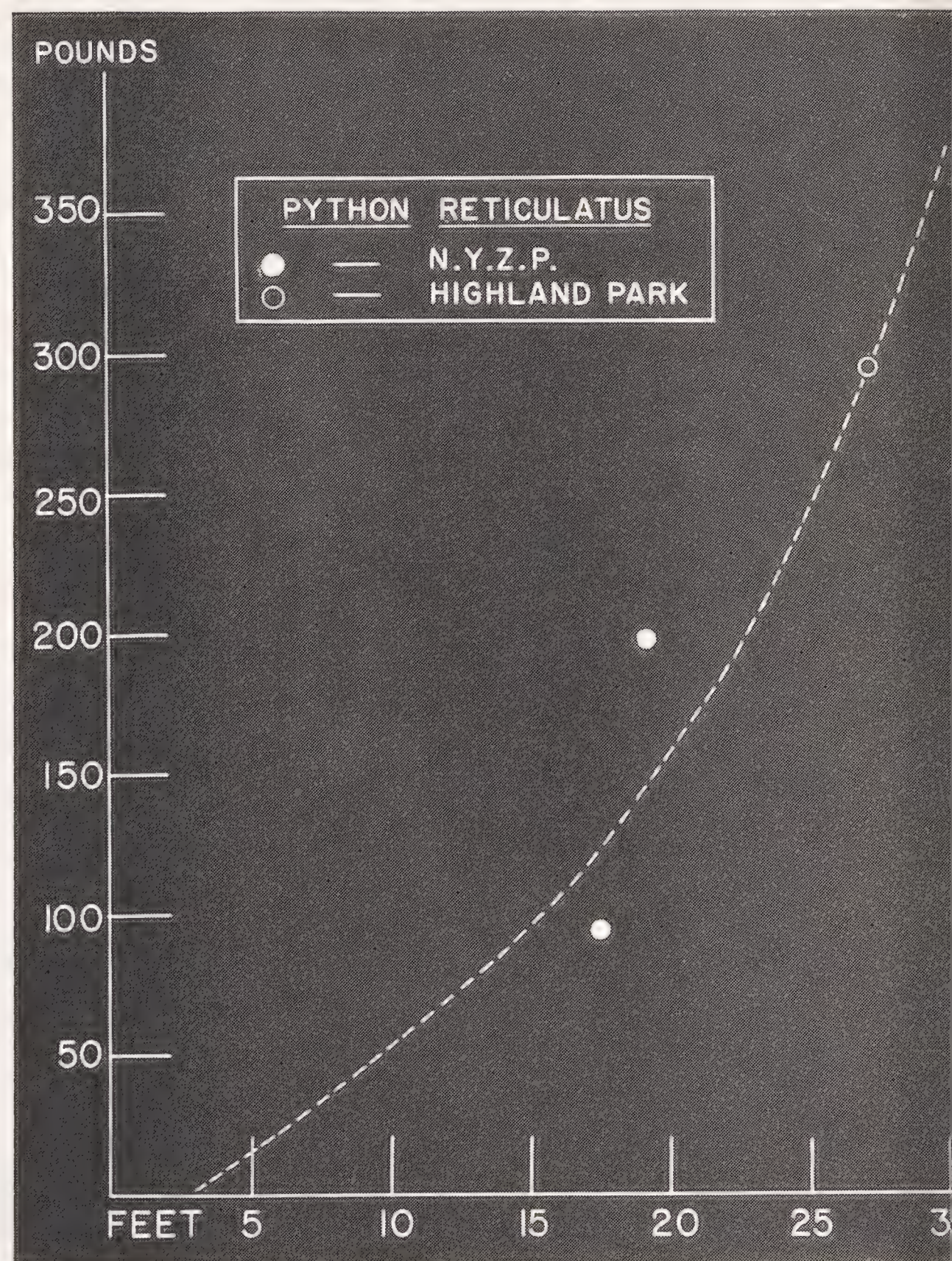


Above — The Reticulated Python named “Colossus,” in the Pittsburgh Zoo, may be 30 ft. long and is probably the largest in any zoo. Right — The graph indicates that a 30-ft. snake weighs about 350 lbs.

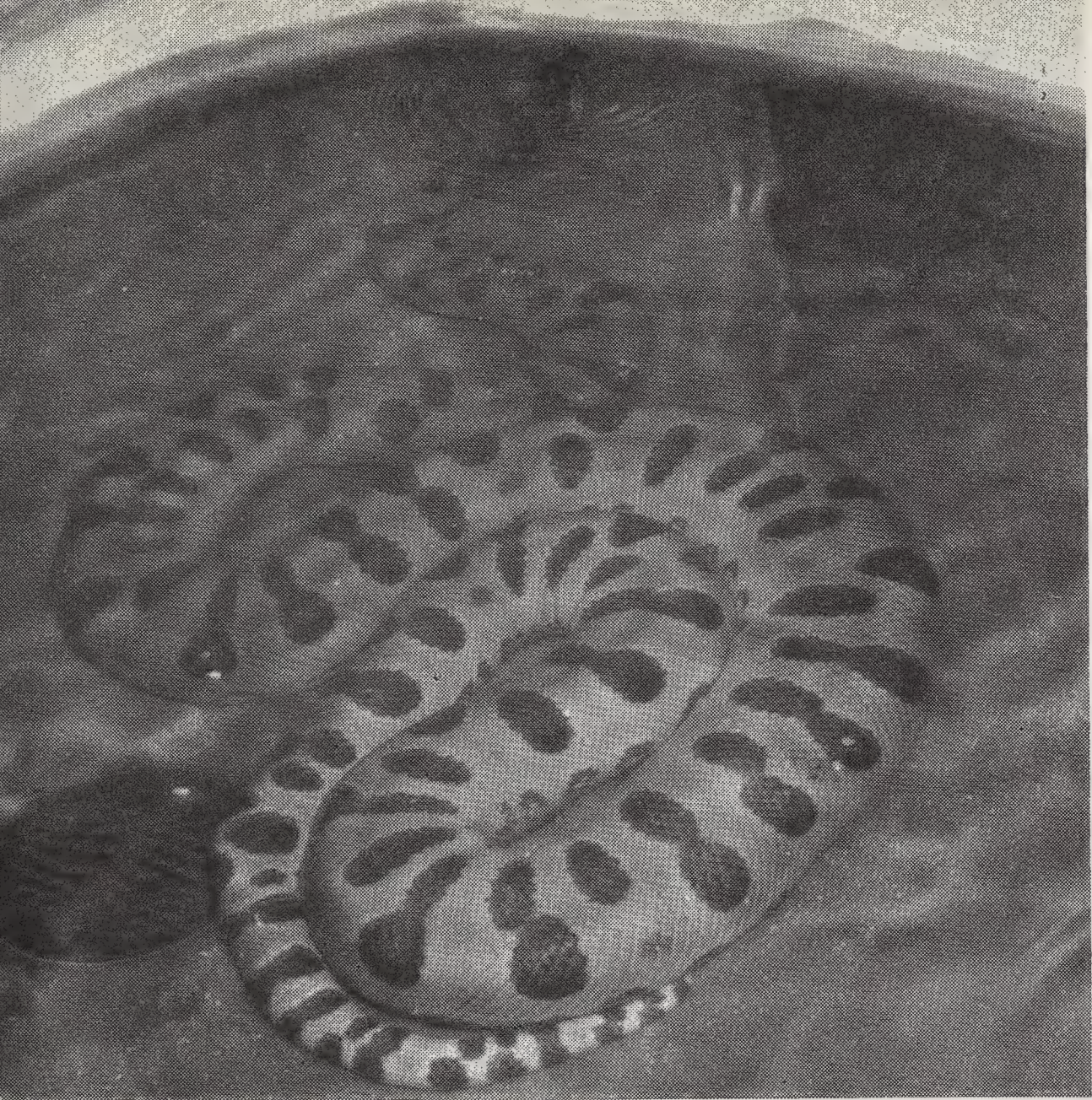
Photo by William B. Allen, Jr., Pittsburgh Zoo

snakes have stimulated this one. Perhaps it, in turn, will stimulate others. One of the papers contained more or less casual observations by Jerry H. Staedeli on the growth of an Anaconda at the San Diego Zoo (*Zoonooz*, 34 (10)) while the other was a study of the growth of several giant snakes at the Highland Park Zoo in Pittsburgh (Barton & Allen, *Zoologica*, 46 (7)). When combined with some of our own information on growth here at the Zoological Park, it is possible to present a somewhat better picture of the growth of several of the giant snakes than has previously appeared.

The recurrent question of which species of snake grows to the greatest length is still not settled, although the question has by now boiled down to whether it is the Anaconda of South



America or the Reticulated Python of southeastern Asia. Without any question, however, Reticulated Pythons (*Python reticulatus*) have always held the prize among snakes that have been brought back to civilization. Although the oft-quoted 32- or 33-foot length appears to be based on an individual killed in the jungles of the



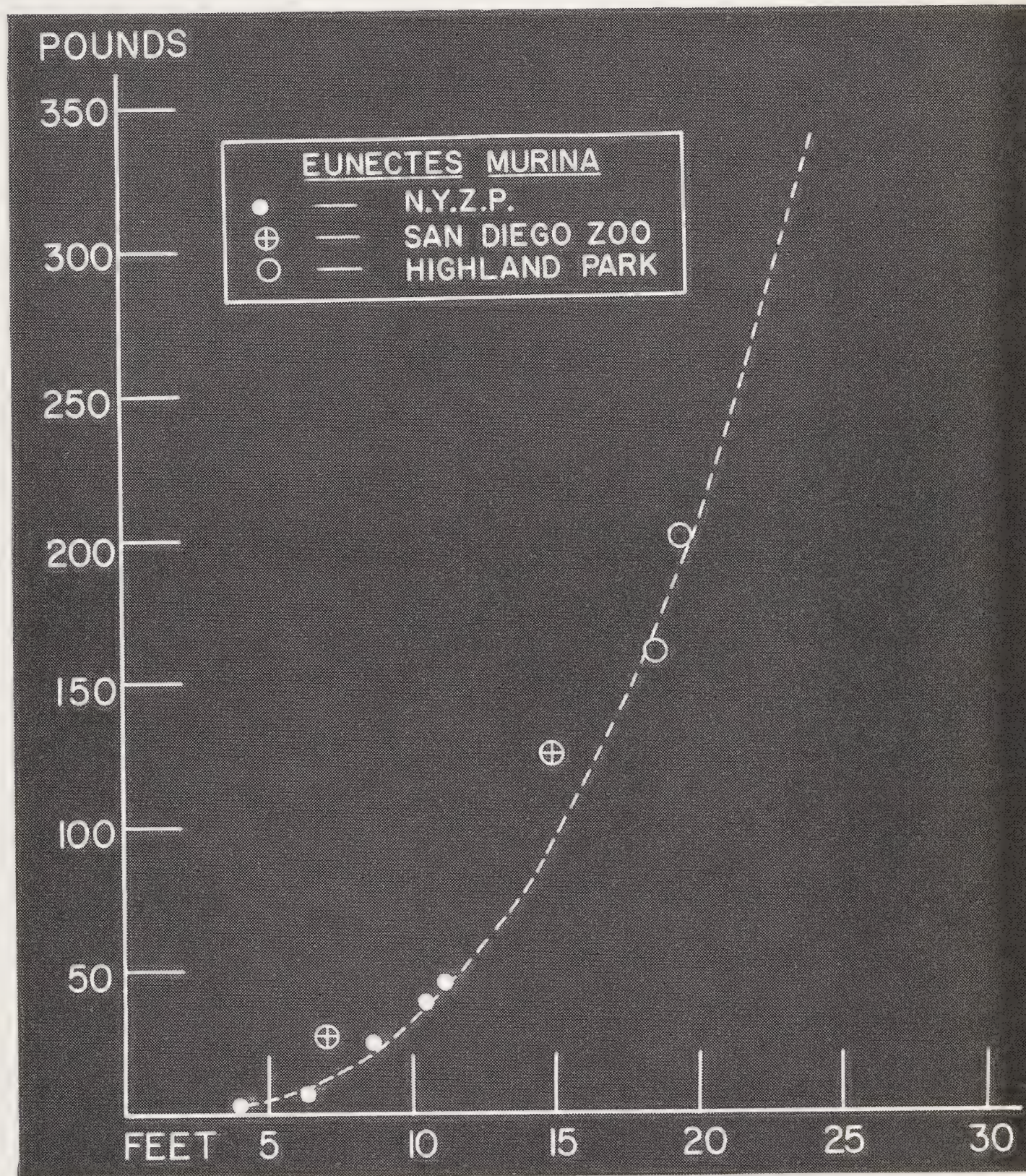
Left — The Anaconda in our collection is 11 ft. long — not a very large snake. Right — We lack data about Anacondas over 20 ft., but the growth curve suggests more than 600 lbs. for a 30-ft. specimen.

island of Celebes, it is also true that several snakes of about 30-foot lengths have been offered for sale by various animal dealers. Even allowing for the shrinkage caused by applying a tape-measure to such snakes, there is no question that this species attains a length in the upper twenties with fair regularity and a 33-foot snake does not seem impossible.

Furthermore, the Pittsburgh Zoo now has a specimen that was 28½ feet long in 1956 and was still growing at a rate of about 10 inches a year. Named "Colossus," this snake would seem to be the longest snake in any zoological park, by a considerable degree.

Always lingering in the background to offset absolute acceptance of the Reticulated Python as the largest of snakes have been the many tales of the huge Anacondas (*Eunectes murina*) that lie in the vast swamplands of South America. An Anaconda 20 feet long is an unusual individual to be displayed in a zoological park and yet everyone who has lived for long in the South American jungles is convinced that these snakes do grow to sizes that are not even suggested by those few individuals that are captured and sent back to civilization. South American herpetologists are convinced, almost to a man, that Anacondas attain a length that is nearer 40 than 20 feet. And of course we do have the report by the late Emmett Dunn's good friend, an engineer, who with his own steel tape measured an Anaconda killed in Colombia — the measurement: 37½ feet.

We must admit, too, that the South American

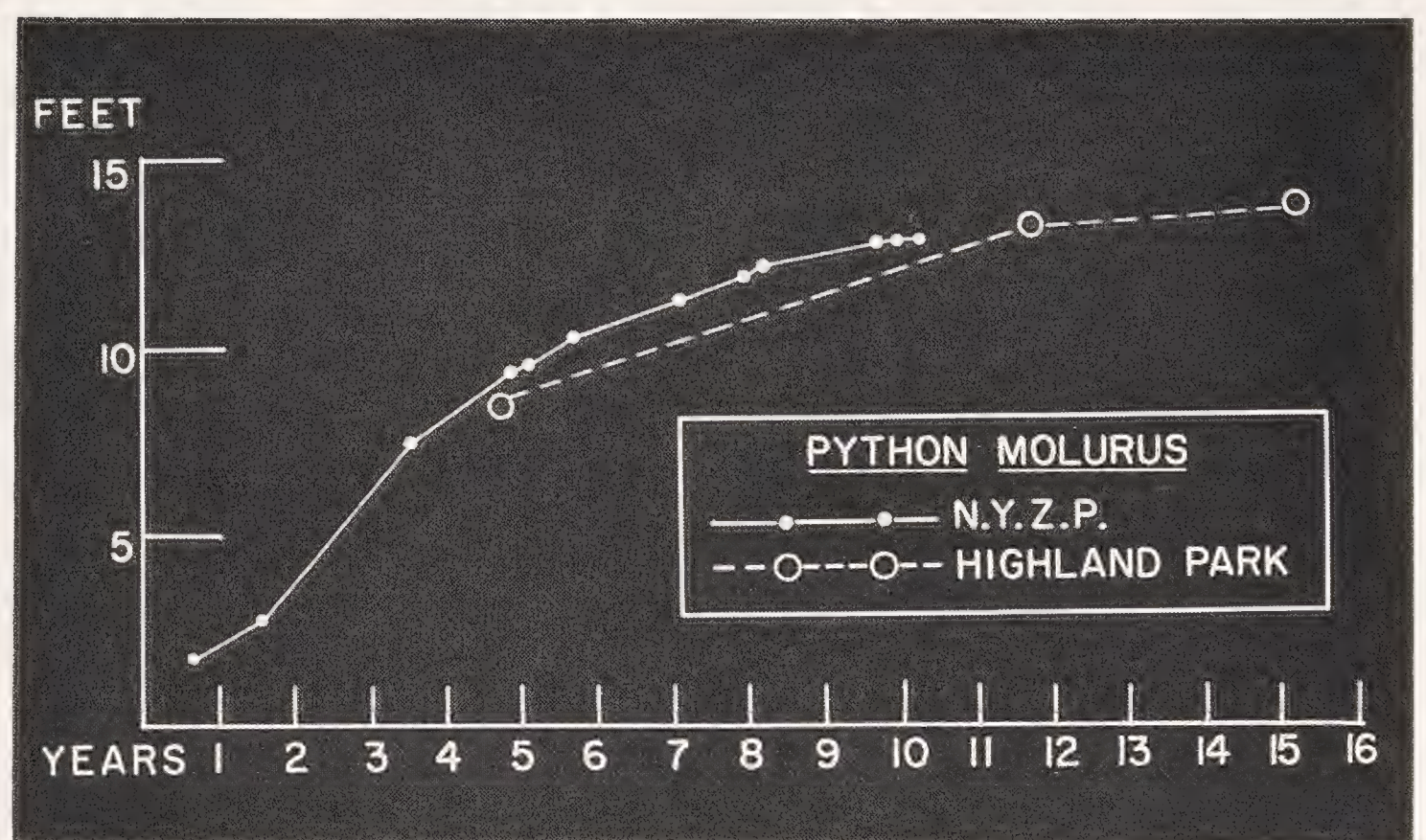


swampy jungles are much less well-known than the heavily populated Far East. Also, when we estimate the weight of even a 30-foot Anaconda on the basis of the weight/length relationships of smaller specimens, we find that such a snake would probably weigh over 600 pounds! On this basis a 40-foot Anaconda would weigh more than 1000 pounds — small wonder that no such specimens have been brought back by foot-weary explorers. It seems likely that no really large Anacondas will ever reach civilization. As high-powered rifles filter farther and farther back into wilderness areas, "big game" of all kinds disappears. It takes many years for a snake to get 30 feet long, even if we allow a growth rate of a foot a year over-all, and most such snakes, frankly, now will just not get the chance.

There are at least three other members of the family Boidae that at least occasionally attain a



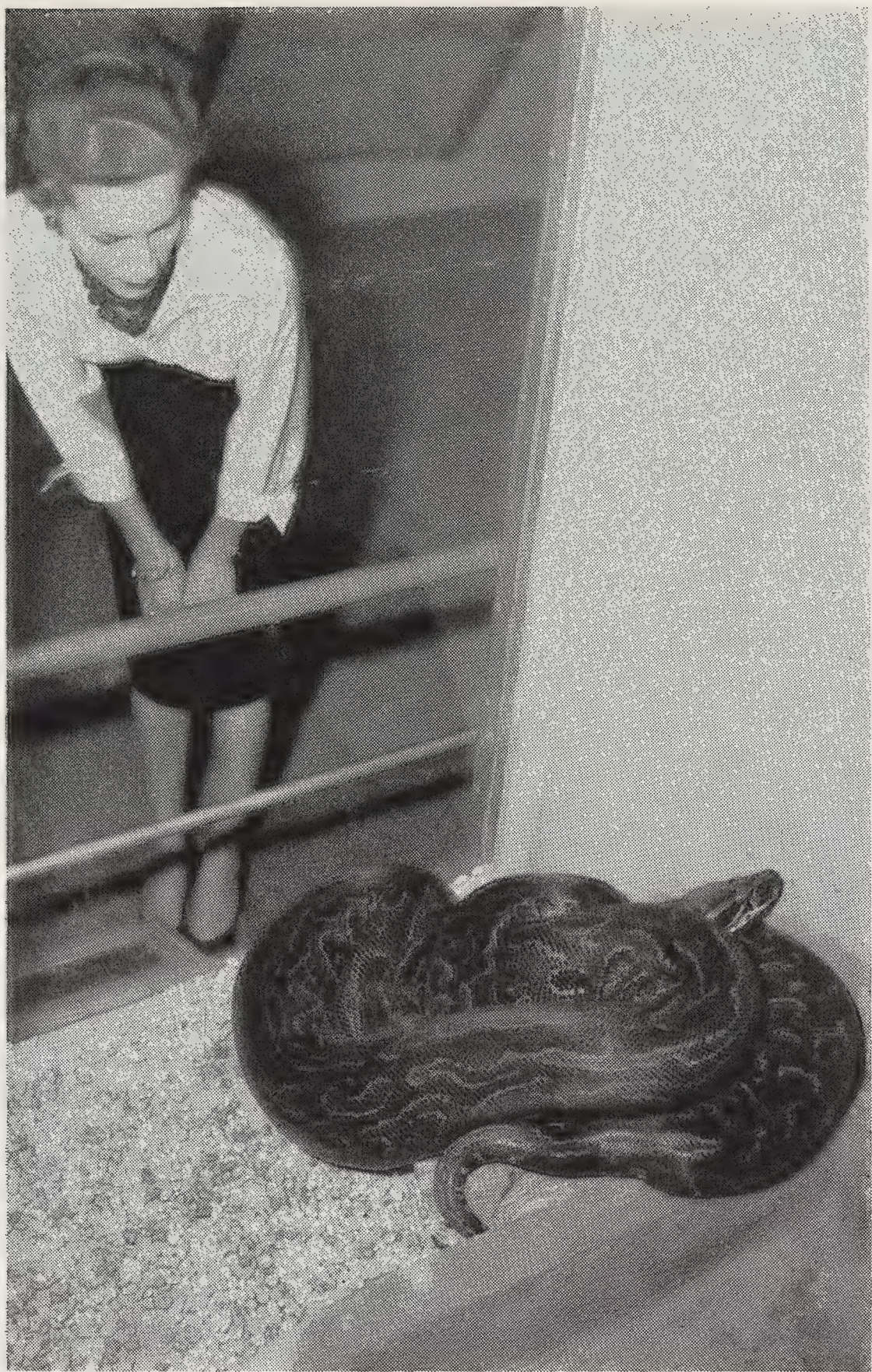
Above — Our Indian Rock Python was hatched in the collection in 1951, so we have accurate figures on its growth. At the age of 10 years, it is just a fraction less than 13 ft. long. Right — A plot of the growth of Indian Rock Pythons in the New York and Pittsburgh Zoos shows approximately identical growth curves.



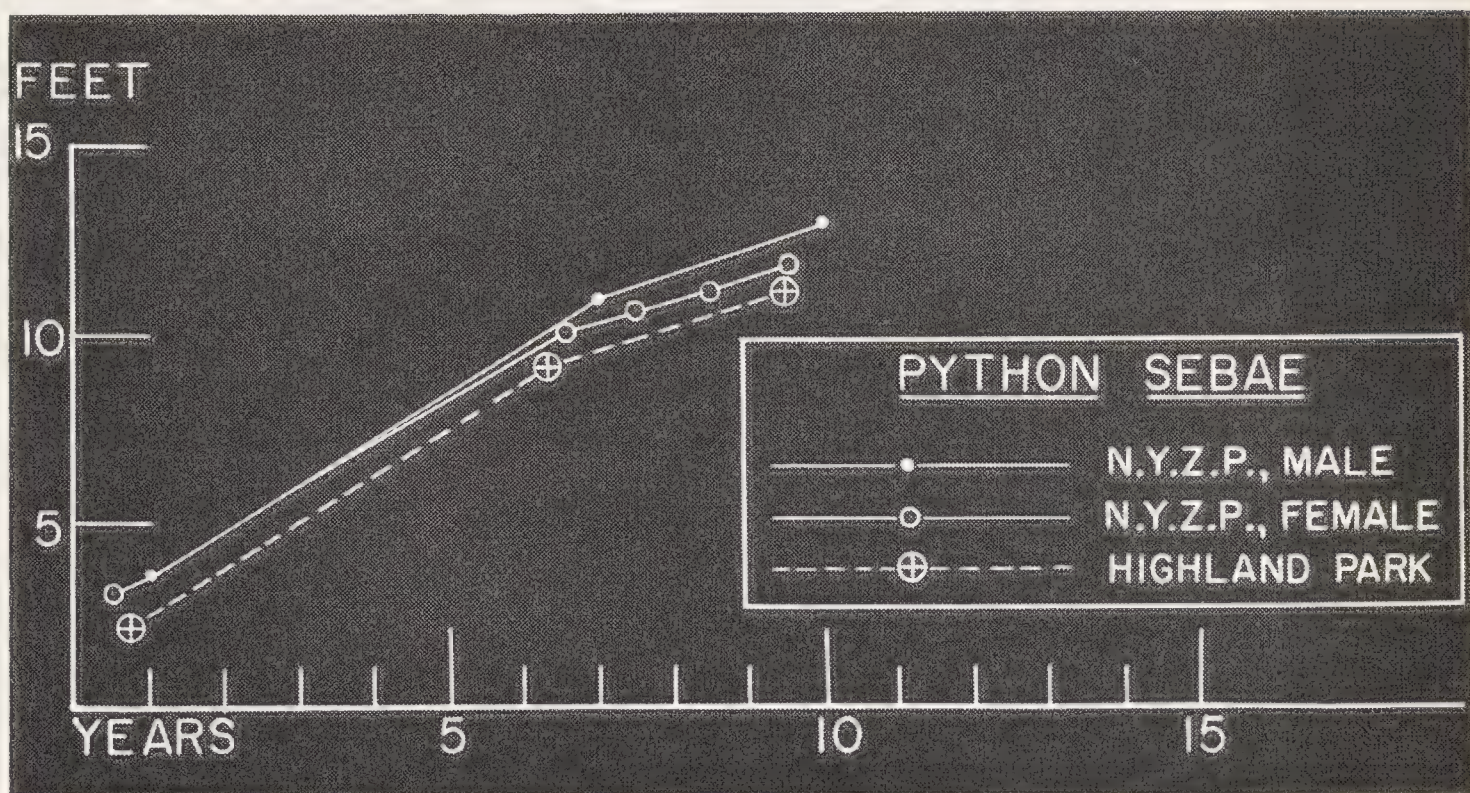
length of at least 20 feet, though no one has claimed as much as 30 feet for any of them. These are the Indian Rock Python (*Python molurus*), the African Rock Python (*Python sebae*) and the Amethystine Python (*Python amethystinus*) of Australia and the East Indies. The latter snake is quite rare and little is known of its habits but the other two are often found in collections and a considerable amount of information has accumulated on their rate of growth, at least in their early years.

Perhaps the best information is on the Indian Rock Python. One of our present specimens was

hatched here in 1951 and it has been measured almost annually ever since. It shows quite a rapid rate of growth for the first six or seven years, to a length of about 10 feet, and then a reduced rate since that time. Our other specimens corroborate this picture. Furthermore, if we assume that the Highland Park snake that was reported on had had a roughly similar growth up to the time it was first measured at a length of slightly under nine feet, an almost identical growth curve is obtained for the succeeding years. These studies also show that it would take a very long time for a snake of this species to attain a



Left — This female African Rock Python in the Bronx Zoo is now 11 ft. 8 in. long. Right — The female in our collection fasted for about half of each of three years and so did not grow steadily after she reached a mature age.



length of 20 feet. Extrapolation of the growth rate at 10 years indicates an age of 34 years for a 17-foot Indian Rock Python. Probably some one has kept this species for this many years, but I can find no records of as much as 20 years — and no growth information for these.

Both the Highland Park Zoo and our own Zoological Park have kept African Pythons for about 10 years. In each case the snake was two to three and a half feet long when it arrived, indicating that it was a year old or less. Our two snakes were later identified as male and female and although their growth rates were almost identical for the first six or seven years, the male forged ahead of the female after that time. The reason for this was easily determined. After reaching maturity the snakes mated and the female deposited a clutch of eggs in each of three years. Since she refused all food from the time of mating until her presence was no longer required to guard the eggs, this meant a fasting period of up to six months in each of these years. The male continued to eat regularly during these

periods and surpassed the female in length and to an even greater extent in weight.

If the growth curve of the male between seven and ten years is continued, it can be seen that he would attain a length of 20 feet in about 20 years. In the same fashion, the female would attain this length in about 25 years. However, it may well be that the growth rate is further reduced with increasing age and that both of these figures are too low. Only additional observations can give us the information necessary to clarify this point.

In any case, in these days when snake longevity has become an expected circumstance among reptile keepers, it is a pleasure to be able to report some of the information that is derived from the long-term maintenance of these interesting animals. Much of the information obtained in zoological parks could not be found in any fashion other than the day-to-day observations of the devoted and interested people who care for them. Much more needs to be known but as long as the observations are made and recorded, I am sure that the ancient cooperative spirit of the various zoological parks will ultimately allow it to be synthesized into a comprehensive picture of the habits and natural history of reptile life.

ZOO NEWS IN PICTURES

Photographs by SAM DUNTON

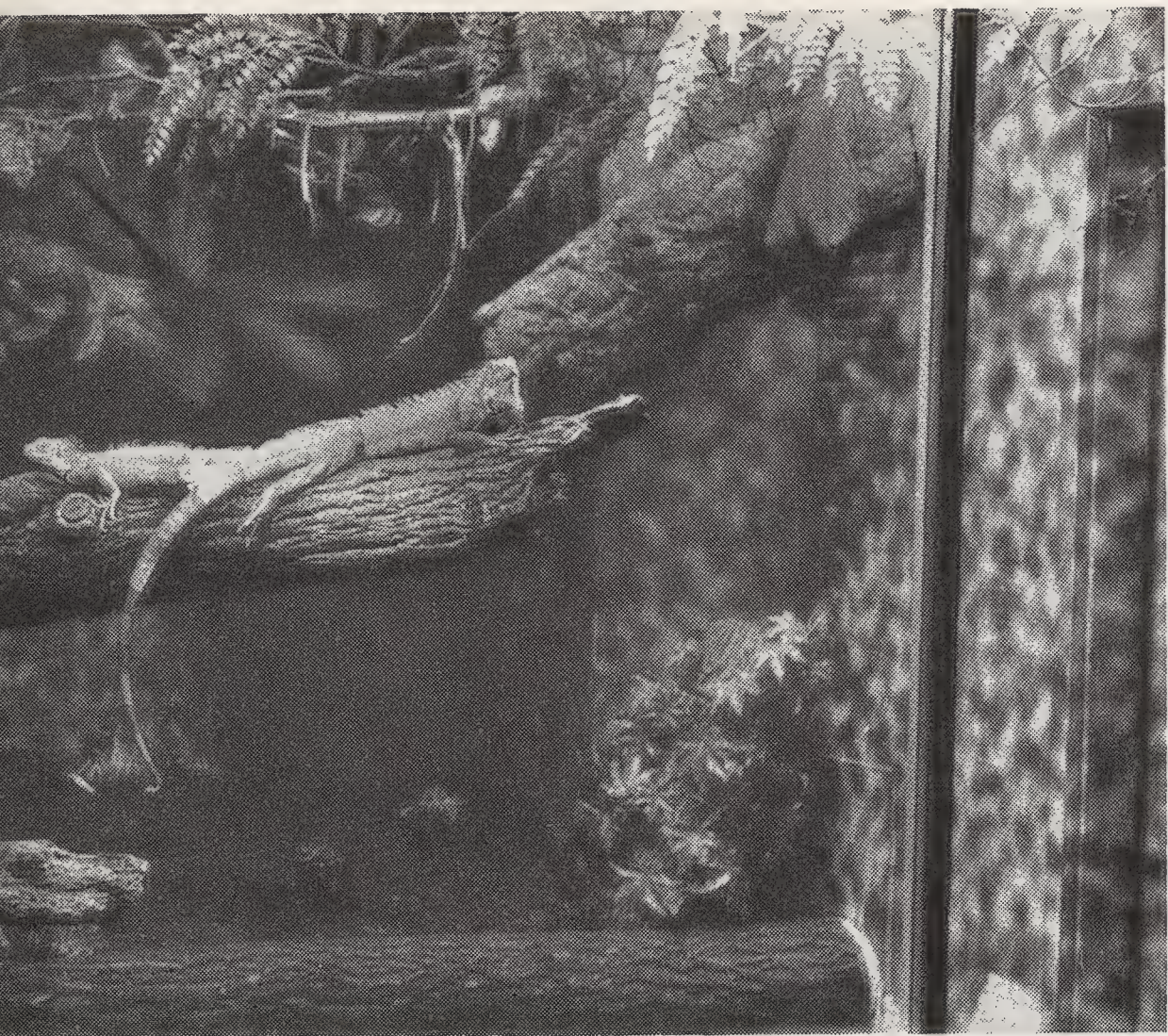


For the first time we are exhibiting the Small Malay Chevrotain (*Tragulus javanicus*). We have a pair, happily living in a compartment in the Small Mammal House. They are wary dwellers of the forest, stand 11 inches high.



Early naturalists writing about the Tasmanian Swamp Hen remark on its extreme shyness and the fact that it can vanish "in the most extraordinary manner" when its suspicions are aroused. We now have two of the birds — our first, a gift of the Basel Zoological Garden — and they are running true to form; they *are* extremely shy. Perhaps they will become less wary later; at any rate, this is the only picture our photographer was able to get in the large area of the outdoor Flying Cage.





Planted to give an impression of the tropical forest of Amazonia, the old Komodo Monitor compartment in the Reptile House has been transformed as a home for turtles and iguanas of various kinds. They are thriving in the tropical heat and humidity and several other reptile species will soon be added.



Two years old — a birthday portrait of our young Okapi, born here on October 17, 1959. "Nejoma" (the name is taken from the names of the three men who attended the birth: Neal, Joe and Matty) has only one fault; he is too gentle and trusting, and was constantly accepting handouts of food from the public until a special barrier was put up.



Thompson's Gazelles, generally known as "Tommies," are familiar enough on the plains of Africa but have never before been seen in our collection. Now we have 8 (6 of them shown here) and sometime during the winter they will be put on exhibition in the Antelope House.



"Like Corn in a Popper" --

WOOD DUCKS LEAVING THE NEST

OF THE VARIOUS AUTHORS writing before 1924 about young Wood Ducks leaving their nests, most reported that the ducklings were carried by the mother duck from the nest to the water or ground. Except when quoting earlier authors, observers writing since 1924 have reported that the ducklings jumped from their nests to the water or ground beneath the nest. Since it is unlikely that Wood Ducks changed their habits just 37 years ago, the question naturally arises whether earlier naturalists constructed their explanations from poorly made observations, around the assumption that the ducklings could not possibly get safely to the ground without being carried from their sometimes lofty tree nests.

In natural situations Wood Ducks make their nests chiefly in tree cavities formed by decay or excavated by large woodpeckers. The height of the cavity above ground has no influence on its use by these ducks, and nests are sometimes as much as fifty to sixty feet above ground. The nests are placed in cavities one to eight feet below the entrance. Nests may be directly over water or several miles from the nearest surface water.

Typical of the early accounts is that of Mark Catesby, in 1731, in his *"The Natural History of Carolina, Florida, and the Bahama Islands,"* in which he stated that young Wood Ducks attach themselves to the back of the female and are thus carried from the nest to water. In his *"Life Histories of North American Waterfowl"* published in 1923, A. C. Bent cited similar behavior reported independently by two observers. In one observation the ducklings were transported on the back of the female from the nest to the water 28 feet below the nest. The duck's behavior was described as follows: "She emerged from the cavity in the stub with a young duck on

By PAUL A. STEWART

Patuxent Wildlife Research Center

her back and simply dropped straight down into the water, using her wings to check the speed of her descent. When she arrived within a foot or two of the surface she suddenly assumed a vertical position which caused the duckling to slide from her back into the water. She rose quickly, circled a time or two, re-entered the stub, and at once repeated the performance until the whole brood of ten were on the water."

In *The Auk* in 1917 E. G. Kingsford reported having observed a duck make eleven or twelve trips from her nest fifty to sixty feet up in a tree to a water area 200 feet from the base of the tree, and each time she carried a duckling by the neck in her beak. Also in *The Auk* in 1924 Henry Mousley reported an observation of a Wood Duck carrying her young in her beak from a tree nest to the ground below. This observation was not made by the author publishing it but was reported to him by an observer thought to have been reliable.

In his *"American Ornithology"* published in 1824, Alexander Wilson also reported the observation of a female carrying thirteen young, one by one, from a nest to the ground at the base of the tree containing the nest. The observation was reported to Wilson rather than having been personally made by him. It was not stated whether the ducklings were carried on the back or in the beak of the female. After the ducklings were all safely transported to the ground, they were led in a group to water.

A. C. Bent suspected the young of being transported by the female duck only when necessary. He stated, "If the nest cavity is not too high, or



A Wood Duck drake in full flight. What is the truth about reports — by so many naturalists of an earlier day — that the female carries ducklings down to the ground from the lofty nest?

Illinois Natural History Survey Photo

if it overhangs the water, or if there is soft open ground below it, I believe that the young are usually coaxed or urged to jump or flutter down and are then led by the old bird to the nearest water." Although Audubon and Bent reported full observations of young Wood Ducks only being carried from their nests to water, these authors suspected that the ducklings may sometimes walk to water after first jumping or fluttering to the ground from their tree nests.

In an article published in *The Condor* in 1924 Joseph Dixon reported having actually observed three broods of young Wood Ducks jumping from their nests to the ground. A list of the persons having made similar observations since 1924 would also be a complete list of persons who have worked with nesting Wood Ducks in that period. In recent years, as far as I know, no one has reported having seen a young Wood

Duck transported by the mother duck from the nest to the ground or to water. I have personally watched seven broods leaving their nests, and all of the ducklings in these broods jumped or fell to the ground or water beneath the nests.

The female leads the ducklings from the nest the day after hatching. Audubon stated that they leave the nest the moment they are hatched, but this is not literally true. Departure from the nest usually takes place in the forenoon, but it may be as late as mid-afternoon, depending on hatching time, disturbance at the nest, and weather. The broods leave the nests earlier on warm sunny days than on cool rainy days.

Before the female leads her brood from the nest, she appears from within at the entrance of the nesting cavity where she pauses, seemingly looking around, for several minutes. If no apparent disturbance is present she soon drops to the ground or, in the case of higher nests, to a tree limb below the nest. There she gives a weak *kuck, kuck, kuck* call, and this acts as a "follow me" call to the ducklings.

In response to this call of the female, the



It is often reported that Wood Ducks fly into their nesting cavities at full speed. This photograph indicates a different approach; here the female Wood Duck is clinging briefly to the exterior of the nest.

*Photo by W. J. Breckenridge,
Minnesota Museum of Natural History*

ducklings in the nest start jumping, like corn in a popper, sometimes merely jumping into the air rather than toward the side of the cavity. With their sharp toenails they succeed in clinging to the rough side of the cavity in some jumps. The first jump puts them about eight inches from the floor of the cavity. A second hitch, in which the opposite foot becomes attached, puts them about four inches higher; thus the ascent continues until the cavity opening is reached.

If the side of the cavity lacks a rough surface, the ducklings are unable to escape, and the cavity then becomes a death trap for them. If, in any of the hitches up the side of the cavity, the ducklings fail to keep their heads above them, they usually drop back to the floor of the cavity and must begin the ascent anew. The bill is not used for support in the ascent but is kept pointed almost vertical, the sharp toenails alone being used for clinging to the side of the cavity. While young Wood Ducks' toenails are very sharp, they do not appear to be sharper than those of other ducklings not using their toenails in climbing from cavity nests. In an effort to test this point, I found I was unable to separate fresh skins of ducklings of the Shoveller and the Wood Duck by examining in a darkened room only the points of the toenails. The Shoveller builds its nest among ground vegetation.

All of the Wood Ducklings in the brood leave the nest in close succession, and usually all are out of the cavity in less than two minutes. Depending on the depth of the cavity and the difficulty of the climb caused by smooth spots inside the cavity, the departure of a brood sometimes takes as much as ten minutes.

After having made the climb to the cavity opening, the ducklings jump to the ground or water. In the descent, they maintain a feet-down position and beat their small wings ineffectively. The ducklings' rate of descent is somewhat less than a stone, as when a stone and a duckling study skin were several times dropped to the ground at the same time from a height of 30 feet, the stone had already reached the ground when the skin was still eight to ten feet above. The ducklings are fluffy and light, weighing less than an ounce, and weigh only 3.2 grams per square inch of surface exposed to resistance against the air when they are falling.



Before leaving the nest, the female surveys the surroundings for some time, to make sure all is quiet. Then she drops to the ground and issues her summons and ducklings jump "like corn in a popper."

Illinois Natural History Survey Photo

Although the ducklings sometimes land on hard ground or bare rock, the impact appears not to harm them. I dropped five day-old ducklings from a height of 20 feet onto a hard limestone drive, and after a moment of delay they all ran from the spot where they fell. One duckling started running with a wobbly gait, suggesting that it had been slightly dazed by the impact, but it soon showed no further signs of injury. They all landed on their feet or bellies.

These five ducklings all voided excrement soon after striking the ground. Several other ducklings were also observed to have voided excrement after jumping onto water from a nesting cavity only five feet above the surface of the water.

Modern observers differ on the extent to which the ducklings bounce on striking the ground, reported bounces varying from zero to several feet. This disagreement doubtless stems from differences in the nature of the ducklings' landing places. I have seen ducklings jump onto hard bare ground and onto loose bare soil, and in both cases they bounced little or none. Several observers have reported that the ducklings bounce several inches when jumping onto grass on a lawn.

The ducklings gather in a compact group soon after they arrive on the ground or water beneath the nest. There they wait with the female until all members of the brood have had an opportunity to clamber out of the nesting cavity. As they follow the female from the nesting site, the ducklings usually remain in a compact group, but they sometimes string out in a line.

Sometimes one or several later hatched and weaker ducklings, unable to climb up the side of the cavity, are left behind in the nest. Some of these remain to die, and some later escape from the nesting cavity either to become lost or eventually to join their own or another brood.

The ducklings are left exposed on open water only a short period immediately after leaving the nest, and if the nest is located so that the ducklings jump directly into water, the female soon leads her brood into hiding cover. If the nest is located over water with no protective vegetative cover nearby, the brood is led to the nearest area offering the combination of water and vegetative cover. If the birds are on a stream, or on a pond with a stream leading from its lower end, they follow the course of the stream. In several known



Right — No, this photograph has not been accidentally turned on its side! It shows a baby Wood Duck just launching itself into the air after scrambling out of the nest hole. Its tiny and all but ineffective wings are in motion.

Illinois Natural History Survey Photo

An even more dramatic photo of a Wood Duckling launching itself in response to its mother's calls from the ground. A nest may be 50 ft. above the ground.

*Photo by W. J. Breckenridge,
Minnesota Museum of Natural History*

cases, movement was downstream rather than upstream, and this was probably because a larger creek associated with vegetative cover lay in that direction.

If the nest is located over land, the trek toward water is immediately started. The family probably takes the shortest course toward water but direct evidence on this point is difficult to get. This overland trek often results in Wood Duck families being seen in strange places. Nearly every small town newspaper within this bird's nesting range has at some time carried a report of a brood of ducklings having been observed on the town streets, sidewalks or lawns. The family's conspicuousness when leaving the nest and the time of day when this occurs often result in the discovery of nests near human dwellings

where they had not been previously suspected.

In leading the brood, the female continues to use her *kuck, kuck, kuck* call, and the ducklings respond by giving a peeping call and by following her. These calls of the female and of the young are relatively weak and cannot be heard when the birds are too far separated.

On a somewhat windy day in May, 1956, I observed a brood of ducklings leaving their nest. After coming out of the nesting cavity the female alighted on a pond at a position of about 10 feet from directly beneath the nest where five ducklings promptly joined her. The female and the five ducklings then moved about 15 feet farther from the nest where they were separated by a steep bank from the remaining five later-coming ducklings. The wind was blowing in a direction



from the ducklings toward the waiting female. The second five ducklings huddled together near where they fell and continued to fail to move toward the waiting female. The fact that the female continued to wait suggested that she heard the calls of the lost ducklings; whereas the failure of the ducklings to join the female suggested that the ducklings did not hear her calls. Presumably the direction of the wind imposed sufficient disadvantage on the ducklings that they could not hear the female although they were heard by her. After waiting some 15 minutes I captured the five ducklings and tossed them toward the female on the water. They promptly joined the other members of their family and disappeared among the nearby vegetation.

A. C. Bent quoted a correspondent who credited the Wood Duck with an ability to count. The correspondent stated, "It was plain that she could count enough to know if one was missing." It is doubtful that this statement is true, and certainly mother Wood Ducks lose many of their ducklings when enroute to water. In Burlington, Iowa, Frederic Leopold observed a loss of 61 from 189 ducklings which moved down a steep bluff and about one city block toward water.

In their early days out of the nest the duck-

lings have a strong tendency to follow any moving object. During most of the time in the first few days out of the nest the mother duck and other members of the brood are the chief moving objects in the presence of the ducklings, and they thus keep together. However, the ducklings sometimes become separated from the mother and other members of their brood; then they readily follow objects in addition to other members of their family. Twice lost ducklings have followed my boat which was being slowly propelled with an outboard motor. In Wood Duck habitat, where other broods of the same species may be present, this following reaction often results in lost ducklings joining broods other than their own. Because of the presence and movements of other ducklings, a duckling lost on water has a much better chance of finding others of the same species than a duckling lost on land some distance from water.

Despite the circumstantial accounts of earlier naturalists — and despite the danger of saying that animals *never* do certain things credited to them — the fact remains that field naturalists nowadays have made plenty of observations of young Wood Ducks jumping from the nest, and none of them being carried down.

THE FAMILY LIFE OF THE MULGARA

By DAVID FLEAY

Fauna Reserve, West Burleigh, Queensland

THE SAND HILLS and salt-bush flats of Central Australia are forbidding country; dry, sun-baked, inhospitable to man. Yet certain four-footed creatures thrive there and it is always a special thrill to an "animal man" when he has the chance to observe any of these at close quarters in the more convenient surroundings of his own zoological collection. I have been able to do that with one of the most charming of Central Australia's specialized animals, a crest-tailed marsupial which the aborigines called the Mulgara, and which scientists term *Dasycercus cristicauda*. It is sometimes called the Crest-tailed Pouched Mouse, too, but it isn't a mouse; it merely looks somewhat like an out-sized creature of that kind and is not a rodent.

It is not too easy to get small pouched animals out of the interior of Australia, and we at the Fauna Reserve were delighted in 1955 when Dr. Peter Morrison, now professor of zoology at the University of Wisconsin, presented us with a pair of Mulgaras when he returned home after studying the metabolism of marsupials in Australia. These little rarities had been dug out of a sandbank at Haasts Bluff in Central Australia in December of 1954.

Bright-eyed, fawn-colored, active, they were delightful and entirely satisfactory exhibits. Not only were they active in daytime, but they were inquisitive about everything new and they had a lizard-like fondness for basking flat out in the sun for long periods — a perfect trait in an animal that we wanted to study closely. In the beginning they were not in very good condition and their coats were poor, as a result of too-prolonged feeding on beef, but plenty of insect food, mice, egg custard and the like soon brought them into condition. They proved to be quite gentle, too — not biting readily, and uttering only the merest heavy

breathing or shushing sounds in the way of mild protest when handled. But on real provocation they could bite — and severely.

The male (and subsequent male offspring) averaged 4½ ounces (127.8 grams) in weight and the female was 3¼ ounces (92.3 grams). Since the common mouse weighs less than half an ounce, it can be seen that the Mulgara is comparatively big game.

The bodies of our pair were clothed in sleek, soft, brownish-fawn hair. The thickened "carrot" tails were especially interesting. The basal portion was covered with bright rufous fur, the terminal half with an arrow-shaft arrangement of comparatively large dorsal and smaller ventral hairs in shining black erectile crests. Perhaps it is by means of this tail structure that, in a sandy environment, the Mulgara's leaps upon its prospective victims are rendered more accurate.

Though comparatively well-mannered toward one another, when the Mulgaras were hungry they were tireless and deadly hunters of insects and lizards and the common mouse. Once a mouse was scented, it was relentlessly tracked down. Instantly the Mulgara would point rigidly, frozen in its tracks, its tail quivering lizard-fashion. Then in a flash it would leap upon its prey and bite across the nape of the neck, rolling and kicking simultaneously with both hind feet. All would be over in a few seconds, but before commencing to feed the little hunter cleaned itself, licking its fur to get rid of the clinging odor of mouse. All the time it would squat near its prey, uttering churring undertones of warning against possible robbery.

It was especially interesting to see that the Mulgaras methodically skinned their prey; starting at the tip of the nose, they usually separated the skin and rolled it back as the body was de-



A typical stance of the Mulgara, with one forefoot raised and folded against the body. The eyes are large and bright and give the Mulgara's face an air of keen enquiry. Its fur varies from buff to brown.

Photo by the Author

voured from head to tail. Often, at the end, the skin was removed and discarded, inside out, without any lacerations.

Strangely enough, although Mulgaras may kill mice or lizards or small birds in a lightning rush, our pair and their descendants were seen to exercise rather comical caution in dealing with grubs, beetles and spiders. They repeatedly shy off such food items and are likely to use their hands in repeated scrabbling actions to confuse and weaken the victim before it is picked up and noisily crunched. This caution may be related to the pugnacity and ready retaliation offered by desert spiders and scorpions.

Like many other marsupials, Mulgaras on occasion go through a convulsive regurgitation of their stomach contents some time after a meal and then reswallow without further chewing.

The family life of Mulgaras had never been

recorded, and naturally we were keen to find out what we could. They were seen mating on July 1, 1955, and not long afterward we removed the male—for we have learned by sad experience that males of the Family Dasyuridae are highly irresponsible and never to be trusted in the vicinity of tender, new-born young.

However, despite our precautions, not a single joey appeared. Possibly the Mulgaras were not yet fully back in condition, or it may be that our handling of the female to inspect her pouch area upset the chances for success.

Oestrus occurred again (as in so many of the Dasyuridae) almost exactly a year later. Mating in 1956 took place initially on June 23 and persisted for 24 hours. Because of captive conditions, there was no means of escape for the now torpid and frayed-looking female and the male was removed on the evening of June 24.

The female thereupon set about building a large and comfortable nest, consisting of bark and leaves which she collected in her mouth from all over the cage. A pouch, as such, did not exist, but its location—normally almost indistinguish-

able from the abdominal fur — now became differentiated by the outward growth of long, tufted, white hairs marking a shallow ridge on each side of the mammary area.

On or about July 21 the female began to keep to her nest most of the time and we judged that it was then that the joeys crawled to the teats. This would indicate a gestation period of about 30 days.

Having had some unfortunate experience with other marsupials, I dared not handle the Mulgara to make sure that she was carrying her babies. However, confirmation came 14 days later when she ran up the netting at the front of her cage to seize a grasshopper. Tiny, very pink, blobs that were almost hidden in the specially developed white hairs made it certain that she had babies, although we could not yet make out just how many.

Week by week the pink cluster became more pronounced and at the age of five to six weeks we could estimate that the joeys, in curled posture, measured $\frac{3}{8}$ of an inch, and that there were six of them. Earlier naturalists had mentioned a maximum of seven in wild-caught Mulgaras, and the number of teats varies from six to eight.

Quite bulky by now, the babies were tightly packed and motionless as their severely handicapped mother moved about. Throughout this period of "permanent" attachment the female stepped high, with arched back and raised tail, to avoid dragging the babies more than could be helped. At this time in particular she was seen to regurgitate food into her mouth and to reswallow it, as in the "cud-chewing" of kangaroos.

On the morning of what was approximately the 58th day (September 16) we saw the female Mulgara frisking through the sunlight, obviously carefree and unhampered. When she sat on a log to go through a methodical toilet of licking and cleaning, we saw that her "pouch" was so empty that it was distinguishable only as a pinkish patch. All her babies had been left behind, in the nest.

The mother seized upon this wonderful opportunity to carry mouthfuls of fresh dry grass into the nest. However, the fact that her family (later determined to be four males and two females) was no longer carried (or should I say dragged?) around, did not mean that they stayed put indefi-

nitely. For some weeks yet they were attached as often as not when she sallied forth. Now they were covered in light gray coats of fur.

Carefree moments while the babies were at home uttering sibilant cries of *cha-cha* often found the mother bolstering up the nest with fresh material or sitting up to wash her pouch, face and flanks. At other times she would lie spread-eagled, eyes shut, in uninterrupted hot sunlight. She seemed to delight in the really intense heat; on the other hand, at night on the desert the temperature drops quite low and the vitality of Mulgaras falls accordingly. On frosty mornings they were often torpid.

The babies' eyes opened at 10½ weeks. They were "bull-headed," furred in yellowish-brown as far as mid-back but more thinly haired further back. The typical fat tails were black-tinted at the end. Now they had become fairly active but

It is easy to understand how handicapped a female Mulgara would be when all six of her babies cling to her. Here only four of the litter have climbed aboard. (One is upside down under its mother).

Photo by the Author

if they were disengaged from their mother for the merest fraction of time they called *chup-chup!* in frantic anxiety until they were able to hook onto her comforting warmth once more. Then she was indeed severely handicapped, for each of the six babies measured some 3¾ inches in length.

Now, as for some time earlier, it was important for her to hunt without the handicap of six dangling weights, and it was diverting to see how she shed her brood. Suddenly she would start a rapid shaking or vibration of her abdominal area so that one by one the babies let go and bunched up with brothers and sisters in the nest.

By late October, at the age of 12½ weeks, the black-tailed offspring began making short and furtive expeditions on their own. But encounters with beetles and grubs always alarmed them and usually ended in frantic sprints for home and mother.

There is a definite play stage in the development of baby Mulgaras when they stalk one another and make simulated ferocious attacks. Like their parents, however, they were not particularly vocal, even in play.

With the coming of November the babies at-



tained the age of $3\frac{1}{2}$ months and to all intents and purposes they were sub-adults, three-quarters grown and independent. Moving most actively in early morning sunlight, they were on the prowl also in late afternoon and at night. We gave them a large, concrete-floored run with hollow logs, grass tussocks and burrowing space, and they did very well indeed and were fascinating exhibits to our visitors, not only because of their good looks and fearlessness but because of their habit (unusual for a marsupial) of skipping about by day. It is a measure of their fearlessness that they often sniffed noses with visiting dogs, through the wire netting of the run. They were not good climbers but nevertheless they could run easily up logs or the wire netting in pursuit of grasshoppers. Unfortunately, small skinks were in the habit of entering their quarters, and inevitably the Mulgaras caught and ate many of them. These lizards are infested with nematode worms and in the ensuing years several members of the Mulgara family died from their effects, in extremely poor condition.

However, there was a further breeding event in which four joeys attained adult status in 1958

and the family is still represented in our collection in 1961.

It is interesting that this delightful desert mammal is the one that Wood Jones reports (in "Mammals of South Australia," Part I) to multiply in astonishing numbers during the passage of mouse plagues across Central Australia. He believes that the Mulgaras are of great value in reducing the numbers of the mice.

Since "pouch" development and mating in our animals in 1955, 1956, 1957 and 1958 occurred only once in the twelve months, and in each year fell within the five-week period beginning in the last week of June, I have wondered whether the multiplication of Mulgaras during mouse plagues (which guarantees plentiful food) was not due to successful development of full pouch loads in the winter seasons rather than an acceleration of the breeding cycle. In very hard times it is doubtful whether Mulgaras would breed at all, and in any case scarcity of food would automatically reduce the chances of survival of *all* the offspring. But those are speculative matters; what is certain is that we have thoroughly enjoyed following the family life of a delightful personality animal.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Navy Scientists Will Work In New Filtration Plant

One of the show-places of the Aquarium at Coney Island is actually a part of its mechanism — the new filtration plant adjoining the Oceanic Pool. An area below decks will be open to special visitors interested in the mechanics of filtration, and a laboratory has been set aside in the plant for use by Navy scientists to test anti-fouling agents. These will be tested on organisms such as barnacles, tube-worms and bryozoans.

Specialist's Care Give to Aquarium's Baby Walrus

One of the three baby Walruses that Dr. Carleton Ray brought to the Aquarium from Alaska last May was stricken with acute trachial bronchitis on October 21. Without the slightest warning, Aivok became seriously ill about 9 o'clock in the morning and thirteen hours later he was dead. Aivok spent most of the day in an oxygen tent under the constant care of Dr. William Antopol from New York's Beth Israel Hospital and Dr. Ray, but he did not respond to the antibiotics and other treatment given him. Hospital laboratory tests revealed that the organism responsible for his death could be controlled with Chloromycetin, and doses of this antibiotic were immediately given to Seeku and Tipuk, the other Walrus babies.

This prompt preventive medication was apparently successful, for the other two Walruses showed no signs of illness, despite their close contact with Aivok. At the time of his death, Aivok weighed more than 300 pounds and had been gaining steadily in weight. Seeku and Tipuk have continued their rapid growth; they now weigh 366 and 322 pounds, respectively, which represents gains of 221 and 202 pounds since their arrival less than six months ago. J.W.A.

IN BRIEF

Animal Nursery. A contract to erect the basic building of the Animal Nursery in the Children's Zoo was let in September and rapid progress is being made towards its completion. It will be opened in the spring, at the time of the opening of the Children's Zoo — the Saturday before Easter.

Injection Gun Use. Development in recent years of injection guns that shoot a syringe loaded with tranquillizers or medicaments of one kind or another has made immeasurably easier the task of the Zoo's Veterinarian. An example was the case this fall of the bull Roosevelt Elk in our collection. Possessed of a magnificent rack of antlers, he dominated the herd unmercifully and finally gored two cows seriously. Before the injection gun came along, it would have been necessary to hold him in an isolation pen for weeks — and the job of treating the injured cows would have been almost impossible. However, Dr. Gandal used the injection apparatus so successfully that the bull was immobilized and his antlers removed; the two cows were also brought down long enough for their wounds to be treated. One subsequently died from the severity of its injuries; in the old days, both might have.

Teachers' Course. The fall session of the In-Service Teachers' Course is again holding weekly sessions in the Zoological Park — the 24th course given by the staff to public school teachers of the city to acquaint them with the facilities of the Zoological Park. This fall 31 teachers are registered for the course, and 1,080 have taken the course since it was established twelve years ago. It is under the general direction of Mr. Knobloch of the Education Department.

Color in Birds. The loss of red, yellow and

orange in a substantial percentage of our small bird collection, particularly in the toucans and cock-of-the-rocks, is a serious problem of which we are made more aware whenever we receive freshly-caught, brightly-colored wild specimens. A section of the Bird Department's quarantine rooms is now being set aside for a series of experiments in the hope of solving the problem. Our successful flamingo diet — now being used by many other zoological parks — seems to be ineffective as an aid in the color metabolism of the small species.

Big Reptile Collection. The Zoological Park's reptile collection is now at an all-time peak with 878 specimens of 290 species.

Growth Inhibitors. For years it has been known that females of a small worm, *Bonellia*, drastically inhibit the growth of *Bonellia* larvae which come in contact with them, but no one had suspected that extracts from females give a similar reaction with other kinds of animals. That this is the case has now been demonstrated by Dr. Ross F. Nigrelli, the Aquarium's pathologist, who has brought back *Bonellia* extract as a result of his European trip this fall.

Fall Closings. The Farm-in-the-Zoo closed for the season on October 15, and the Children's Zoo on November 12.

Rajpur Is No More. Rajpur, our Tiger patriarch, has been ailing for some time and showing various senile infirmities. With the reluctance born of many years of memories, the "old man" was destroyed on October 5. He was born here on February 8, 1944, and in his prime was estimated to have weighed considerably more than 500 pounds. Bred to his litter mate, Dacca, they produced 32 cubs between 1948 and 1959.

Scientific Interests. At the meeting of the American Institute of Biological Sciences at Purdue University, the Aquarium was represented by four papers, three by Dr. Nigrelli and one by Dr. Kallman of the Genetics Laboratory. These dealt with the effects of copper on fish, certain effects of atomic radiation on salamanders, the testing of poisons from sponges by means of sea-urchin eggs and a description of how transplantations can be used to reveal parthenogenesis and other unusual methods of reproduction.

PUBLICATIONS OF INTEREST

A COLOURED KEY TO THE WATERFOWL OF THE WORLD. By Peter Scott. 23 plates in color, many line drawings, 91 pp. Chas. Scribner's Sons, N. Y., 1961. Price \$3.50.

First published in 1948-49, with drawings in black-and-white, in the 2nd Annual Report of the Severn Wildfowl Trust, this useful little book appeared in 1957 with illustrations in color. The present edition has been considerably revised, particularly in regard to intervening changes of opinion as to nomenclature and relationships. Peter Scott's well known competence with the brush and his intimate knowledge of waterfowl in life, gained both in the field and as Honorary Director of the Severn Wildfowl Trust, have already firmly established his "Key" as a classic. It is not only definitive but clever, particularly in the division into groups for ready identification under "Size," "Shape," "Colour," "Voice," "Behaviour," etc., ending with what to do "If you are stuck." With this book in hand, the last would seem to be a situation very difficult to achieve. — L. S. C.

UNRESTING CELLS. By R. W. Gerard. 434 pp., many drawings and photographs. Harper Torchbooks. Paperbound. \$2.25.

THE EVOLUTION OF HUMAN NATURE. By C. Judson Herrick. 500 pp.; drawings. Harper Torchbooks, New York. Paperbound. \$2.45.

Students of biology will welcome these inexpensive, paperbound editions, the first originally published five years ago and the second more than twenty.

THE FERN GUIDE. By Edgar T. Wherry. 318 pp., many drawings by James C. W. Chen. Doubleday & Co., New York. \$3.95.

HOW TO KNOW THE FERNS. By Frances Theodora Parsons. 215 pp., many drawings by Marion Satterlee & Alice Josephine Smith. Dover Publications, New York. Paperbound. \$1.25.

These two identification-guides serve different audiences; the former is excellent for the serious amateur, the latter for the casual hobbyist.

ALEXANDER WILSON: Naturalist and Pioneer. By Robert Cantwell. 319 pp.; 8 color plates, 16 pp. of black-and-white illus., decorations by Robert Ball. Lippincott & Co., Philadelphia, 1961. \$15.00.

This is the first modern biography of that unhappy Scottish-American wanderer, Alexander Wilson, author and illustrator of *The American Ornithology*, whose nine volumes appeared between 1808 and 1814. (There is, incidentally, a full set, with Bonaparte's continuation, in the Zoological Society's library). Wilson was one of the pioneering "greats" in American natural history, well-deserving of Mr. Cantwell's prodigious research into his Scottish boyhood and his patient exploring of Wilson's career and associates in America. It is a pity that the high price of the book may keep it out of the hands of many who would find it of the greatest interest.

THE LAND THAT SLEEPS. By G. M. Glaskin. 294 pp.; photographs, maps. Doubleday & Co., New York, 1961. \$4.95.

The author and a companion recently made an automobile trip along the coast of Western Australia and down through the Northern Territory. Mostly it is a desperately bleak land — with enormous potentials which the author constantly stresses. The book is fascinating armchair travel today; a generation hence, if the area develops as it well may, it will be a valuable source book on the "early days."

DISCOVERY: Great Moments in the Lives of Outstanding Naturalists. Edited by John K. Terres. Wood engravings by Thomas W. Nason. 338 pp. J. B. Lippincott Co., Philadelphia. \$6.50.

Thirty-six widely-known naturalists tell the stories of moments or events or discoveries that have illuminated or influenced their lives. Many are well known to readers of *Animal Kingdom*: Peterson, Murie, Eckleberry, Darling, Kieran, Skutch, Chapin, Armstrong, Delacour, Carter. This is an excellent book for a beginning naturalist, to show him the variety of experience that may come his way.

MAN AND DOLPHIN. By John C. Lilly. 312 pp., 49 photos, 3 drawings. Doubleday & Co., Inc., Garden City, N. Y., 1961. \$4.95.

A popular idea about animals is that some of them are smarter than man. Up to now, however, no scientist has ever seriously entertained such an idea, mostly because no animal even approaches man in the complexity, variability and adaptability of its behavior; in particular, no animal has developed a culture or can communicate by means of words. Dr. Lilly now challenges this concept of the uniqueness of *Homo sapiens*. On the basis of studies made of the Bottle-nosed Dolphin or Porpoise, Dr. Lilly advances the proposition that these aquatic mammals possess a language with abstract symbols and some sort of culture as well. He also is convinced that it

is only a matter of time before we can communicate with them, either by learning "dolphinese" or by teaching them English.

These are truly revolutionary ideas, and if they prove to be correct, Dr. Lilly will take his place next to Darwin as one of the greatest, most creative innovators in Biology.

There is nothing wrong with radical scientific theories or hypotheses; in fact, they may serve to advance knowledge even if they do no more than stimulate new thoughts or clarify old ones. Dr. Lilly cannot be criticised because of the originality of his ideas or the breadth of his imagination. Unfortunately, however, he has chosen to write a popular book, filled with irrelevant personal details, as the way to present his data and conclusions. Its popular format may explain why there is hardly a single observation or interpretation in it that would not be questioned in a court of scientific law. Strong evidence in favor of Dr. Lilly's hypotheses has yet to be brought forward. On the other hand, the public has accepted Lilly's "talking porpoises" with open arms. Scientists and educators who believe that it is important for the members of a democratic society to have a rational view of animal life can only wish that Dr. Lilly had not felt called upon to put himself so prominently in the public eye. — J. W. Artz.

New Members of the New York Zoological Society

(Between September 1 and October 31, 1961)

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Founder in Perpetuity

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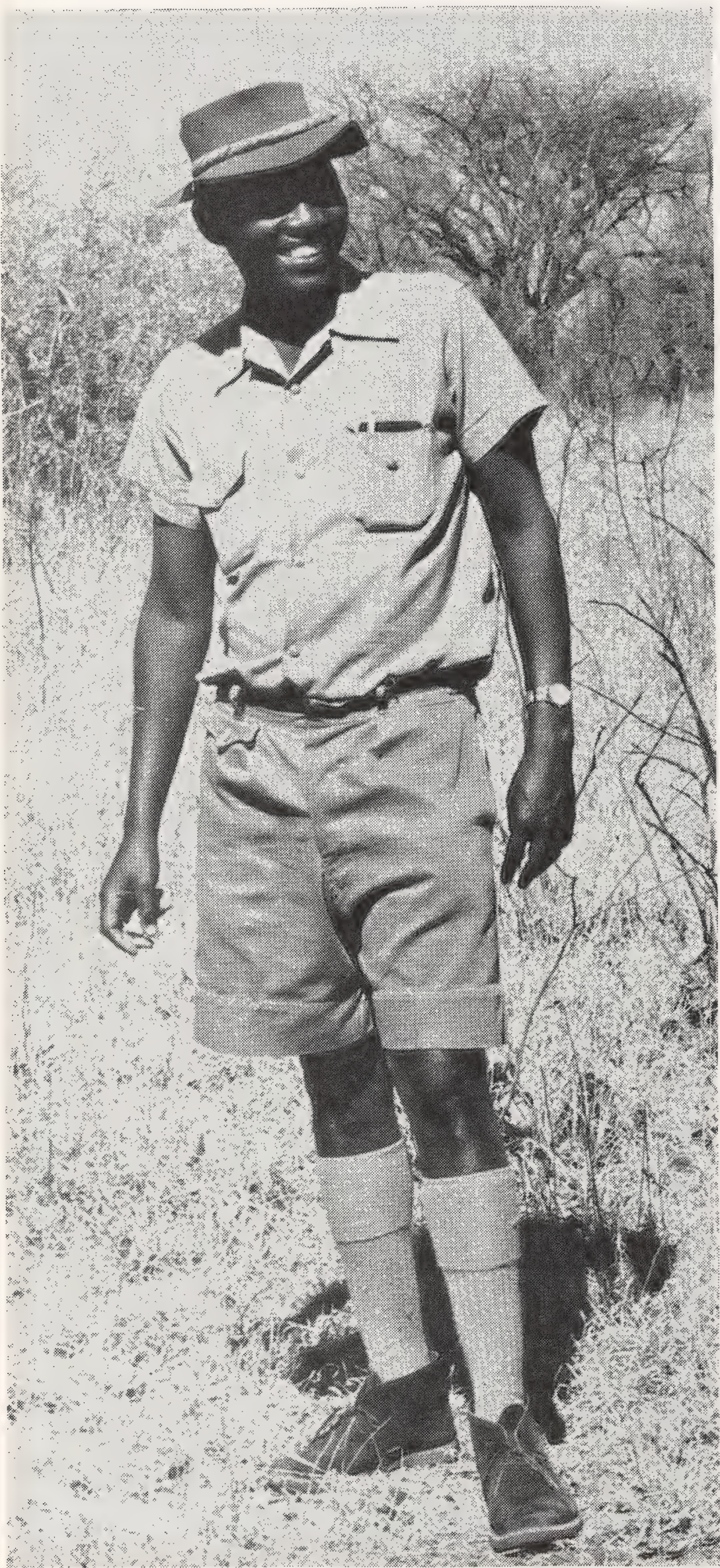
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There Will Be More Society Newsletters



Senior Scout Sidney Simpelwe

SENIOR SCOUT SIDNEY SIMPELWE's recent newsletter from Southern Rhodesia to Members of the Zoological Society is unique. It's the first report on wildlife survival written by an African that we've ever seen and it conveys a picture of native attitudes that only a native could perceive. In the way it brings news directly from the field to Members, Mr. Simpelwe's letter ranks with the great newsletters Members have received since 1947.

Curator of Publications William Bridges started the whole thing by air-mailing on-the-spot reports about Charles Cordier's quest for the Congo Peacock. When Jocelyn Crane went to Tahiti in 1956, she was prevailed upon to write Members about the fiddler crabs in the mudflats of the South Sea Islands. Other notable newsletters followed: William Beebe's description of tropical research in Trinidad; George Treichel's analysis of African parks and wildlife refuges; David Fleay's account of his capture of platypuses for the zoo; William Conway's saga on his expedition to find and bring back James's and Andean Flamingos; and Jim Simon's newsletter of last Spring about the competition between Masai cattle and wildlife for water and grazing land.

If you want a friend to receive the next Society newsletter, please send us the name now. We don't know yet *where* the next letter will originate, but we can predict it will be as topical and fresh as its great predecessors.





THE CRISIS FACING WILD ANIMALS IN AFRICA

THE CRISIS FACING WILD ANIMALS IN AFRICA

A report on the efforts of the New York Zoological Society and its affiliate, The Conservation Foundation, aimed at protection of the world's most remarkable fauna.

Several years ago it became clear that the rapidly-increasing destruction of wild animals in Africa would lead to the extermination of many of the most remarkable animals on this earth. So grave was the situation that our Society resolved to do everything in its power to help avert the crisis. This report summarizes what we have done up to now.

It was not easy to determine the most effective way to start, but we decided that the basis of intelligent action must be accurate knowledge of the *over-all* situation of African animals. To gain this broad view, we commissioned George Treichel, a geographer and ecologist, to survey the status of National Parks and Game Reserves everywhere south of the Sahara and to gather all possible information about the special problems of protecting African fauna. This was obviously a big job and its first phase involved almost two years of travel, direct observation and interviews. The second phase, the compression of an enormous amount of field material into a handbook, was interrupted when Mr. Treichel became seriously ill during his last week in Africa. But the book is now in final form and will go to publication later this year; it is thoroughly up-to-date, for Mr. Treichel as ecologist for the International Union for Conservation of Nature and Natural Resources is in close touch with the African situation. As we had hoped, its information is basic and invaluable — the first compendium of its kind.

In the light of knowledge gained from this survey, it seemed best to concentrate our efforts for the most part on eastern and central Africa and to channel them along four lines:

EDUCATION — aimed both at Africans and at interested people in other countries

RESEARCH AND FIELD SURVEYS — primarily on the ecology of African animals

DIRECT AID — for the development of new water sources, equipment for control of poaching, etc.

SUPPORT — of organizations and individuals working on African wildlife problems.

To put this program into effect, in January of 1959 the Zoological Society established the African Wild Life Fund. To it Members of the Zoological Society and other friends of African wildlife have generously contributed \$55,000. This present report summarizes for them how their funds have been put to use. It refers also to the use made of other special funds held by the Zoological Society and to some projects financed and carried out by The Conservation Foundation.

EDUCATION

Support has been extended to the following:

A grant to the Kenya Wildlife Society of Nairobi, an organization active in educational work in British East Africa. It conducts an active educational program in the African schools through films and lectures.

1960-61 *inclusive*: NEW YORK ZOOLOGICAL SOCIETY
(CONSERVATION FUNDS); AFRICAN
WILD LIFE FUND; THE
CONSERVATION FOUNDATION

\$3,975

Training of an African game scout, Sidney Simpelwe, in Northern Rhodesia, in the techniques of game ecology and management.

1960-61 *inclusive*: AFRICAN WILD LIFE FUND **\$3,600**

A grant to Makerere College, Kampala, Uganda, for vocational work with the Uganda Game Department for selected students.

1960-61 *inclusive*: AFRICAN WILD LIFE FUND **\$1,008**

A documentary film is now being made in Kenya and Tanganyika that will present the fatal competition in the Masai country between cattle and wild animals for the essentials of survival — water and forage. This film will be the first of its kind, in that it deals with the interlocking relationship of man and land and animals. The theme will be adapted for distribution to Africans as well as to audiences in other parts of the world.

Expenditures to date: AFRICAN WILD LIFE FUND **\$18,000**

RESEARCH AND FIELD SURVEYS

Support of work by Dr. A. M. Harthoorn and Dr. J. A. Lock of Makerere College, Uganda, on the development of techniques for the immobilization of game. Basic studies of the ecology, migration patterns and feeding grounds of plains animals cannot be effectively accomplished without marking and thus identifying individual members of a herd. (Such essential techniques are similar to those of banding of birds in order to acquire knowledge of their migrations, feeding and breeding grounds).

Amount of grants — covering

1960-63 *inclusive*: AFRICAN WILD LIFE FUND **\$7,000**

Support of a two-year field study by Dr. Lee M. Talbot of the migration and food habits of the wildebeest and other plains

animals in the Mara region of Kenya and northern region of Tanganyika. Principal support has come from the National Academy of Sciences, Washington, D. C. The Zoological Society has supplemented this grant, from the African Wild Life Fund and other reserve funds of the Society, so as to extend Dr. Talbot's work through a second year, to June 1, 1961. As an indication of the importance of this work, a supporting grant of \$2,000 has been received from the Game Department of the Government of Kenya.

Combined support from NEW YORK ZOOLOGICAL
SOCIETY SOURCES **\$4,800**

An ecological reconnaissance of the Mara Plains, one of the finest wildlife areas remaining in Africa, has been completed by Dr. Frank Fraser Darling, Vice-president of the Conservation Foundation. This project was also sponsored by the Kenya Wildlife Society and the Royal National Parks of Kenya. Publication of findings now available.

Funds jointly supplied by the NEW YORK ZOOLOGICAL
SOCIETY *and* THE CONSERVATION FOUNDATION **\$2,800**

An ecological survey of the Mara Mau region in Kenya is now under way. This region is outstanding, carrying a large assemblage of plains animals in the Mara Plains and rising into the great juniper and bamboo forests of the Mau massif which are now suffering conflicting inimical land uses, both cattle-grazing by the Masai and forest invasion by the Kikuyu. In recent years many parts of the country have been severely burned and eroded. This study will provide basic information that can be used as a reference base in the evolution of the Mara Mau. The survey will be carried out under the direction of Dr. Philip E. Glover of the Government Veterinary Research Laboratory at Kabete, Kenya.

<i>Grants from</i> THE ROCKEFELLER FOUNDATION	\$7,500
<i>and</i> THE CONSERVATION & RESEARCH FOUNDATION, INC.	
OF NEW LONDON, CONN.	5,000
<i>Funds supplied by</i> THE CONSERVATION FOUNDATION	2,500

At the invitation of the Sudanese Government, a survey was made in March of this year by Dr. Darling, assisted by George W. Merck, Secretary of the Zoological Society, to draw up a report on wildlife policy and on administration of National Parks and Wildlife Reserves in the Sudan. Field costs provided by the Government of Sudan, travel costs of Dr. Darling and Mr. Merck to Khartoum provided by

NEW YORK ZOOLOGICAL SOCIETY	
<i>and</i> THE CONSERVATION FOUNDATION	\$2,095

DIRECT AID

New watering sources:

Funds have been advanced for the establishment of new watering sources for wild animals within and adjacent to the existing National Park system of Kenya and Tanganyika. Permanent water is not abundant over much of East Africa and insufficient water within National Park boundaries frequently forces wild animals to migrate elsewhere without adequate protection. An additional well is presently under consideration in Masailand so that cattle will not need to penetrate within National Park boundaries.

AFRICAN WILD LIFE FUND	\$7,050
------------------------	----------------

Plane to control poaching:

Contribution was made to the Tanganyika National Parks towards the purchase of a Cessna plane to control poachers in the

Serengeti National Park. The plane was delivered in January, 1961, and is now in service.

AFRICAN WILD LIFE FUND

\$2,000

SUPPORT

An honorarium and expense fund has been provided to Noel M. Simon, Chairman and a Founder of the Kenya Wildlife Society, to facilitate his work in wildlife protection.

Years 1959-61 inclusive:

NEW YORK ZOOLOGICAL SOCIETY

and THE CONSERVATION FOUNDATION

\$10,375

OTHER PROJECTS

Jointly with the Fauna Preservation Society of London, an appropriation was made to initiate a long-term wildlife protection and ecological project to be carried out under the sponsorship of the International Union for Conservation of Nature and Natural Resources, whose headquarters are in Geneva. This fund has enabled Dr. Gerald Watterson, on loan to the International Union from the United Nations, F.A.O., to assess the resources problems as well as policies and programs to be established concerning them in the new African States. Initial surveys have already been made in Ghana, Côte d'Ivoire, Dahomey, Togo, Cameroon, Centrafrique and Nigeria. The gathering of this material is preparatory to the Pan African meeting of conservationists and legislators to be held in Arusha, Tanganyika, in September of this year.

Funds provided by

NEW YORK ZOOLOGICAL SOCIETY

\$2,000

In summary, funds in excess of \$79,000 have been expended or are now pledged toward these key activities — each one of them directly involved in the preservation of irreplaceable wild animals.

Obviously the current social and political changes in Africa have made wildlife conservation more difficult. But only more difficult; there is no reason for despair. Indeed, the very fact that such institutions as the New York Zoological Society and The Conservation Foundation have launched coordinated programs to help meet the crisis has strengthened and renewed the hope of the friends of wildlife in Africa and elsewhere. As the only two independent organizations in the United States to come to the rescue in a systematic way, we feel that we *must* continue to do everything we can to help. We know we have made a good beginning and while we have no illusions about the work still to be done, we, too, are hopeful. We must, we *can*, help save Africa's wildlife heritage for future generations.

This brief report is dedicated to all those friends of African animals who, through their financial support, are making it possible for us to express America's concern.

* * *

The work, as you will have gathered, is well under way. We can proceed only as fast as funds permit.

ANIMAL KINGDOM

NEW YORK ZOOLOGICAL SOCIETY



VOLUME LXV

JANUARY TO DECEMBER, 1962

Numbers 1-6

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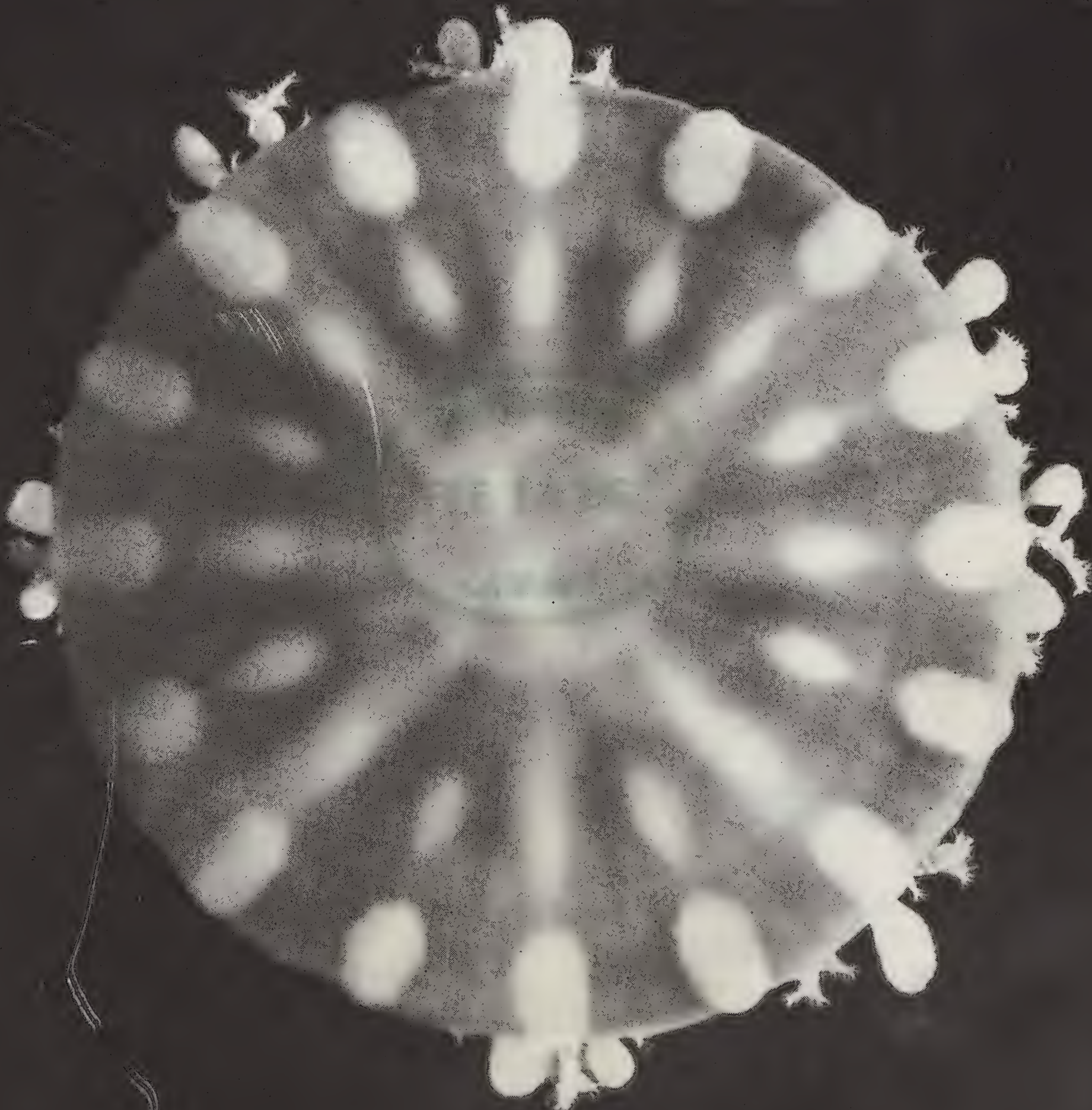
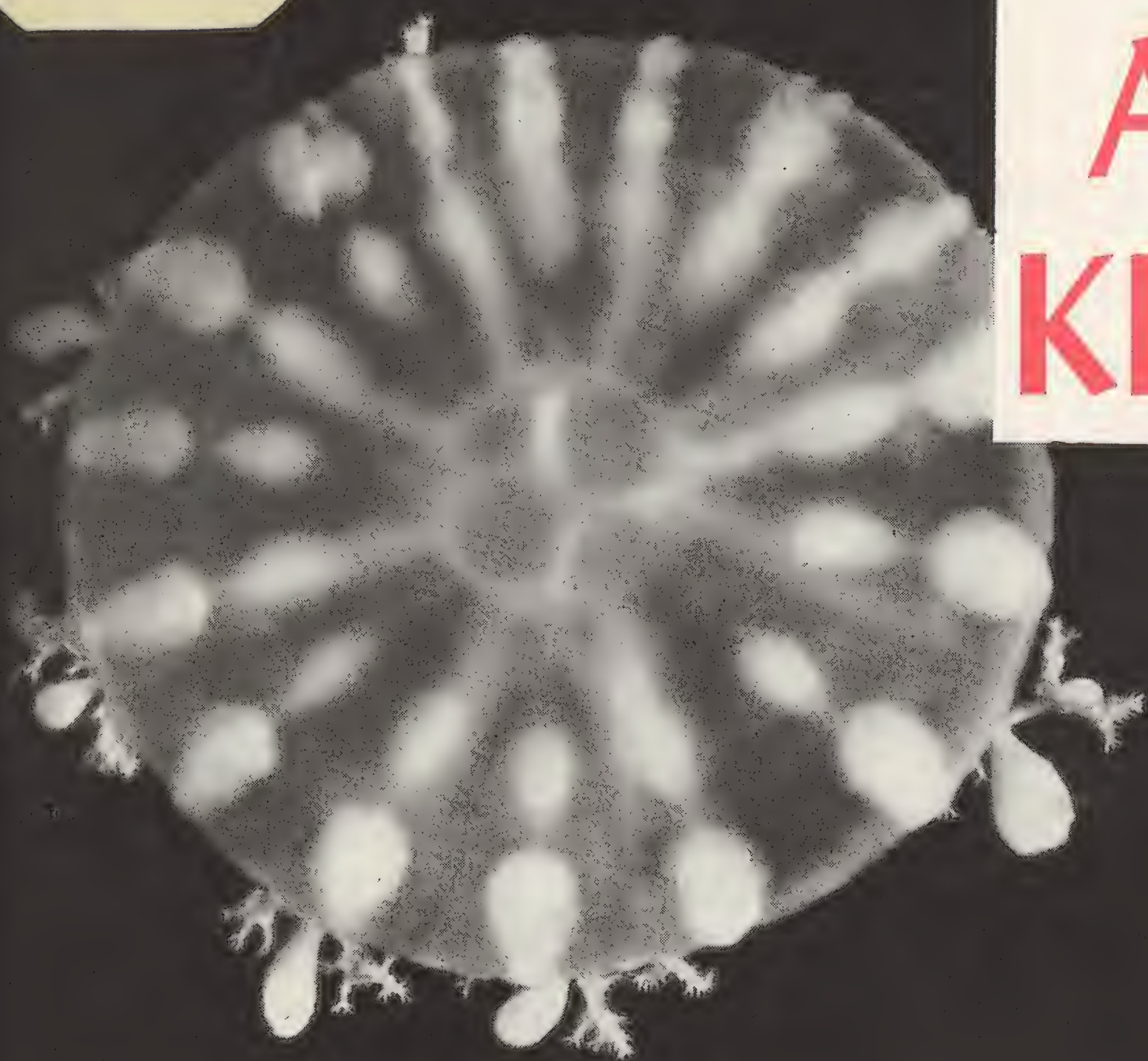
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ANIMAL KINGDOM



ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Arts of Nature and Arts of Man

President Fairfield Osborn's Remarks at the
Annual Members' Meeting of the Zoological
Society, Monday Evening, January 8

I SHALL NOT be so misguided as to try to measure the relative values of the Arts of Nature as compared with the Arts of Man. Comparisons can be odious and are usually unnecessary.

Nevertheless, I must make one or two observations on this subject.

First, when speaking of the Arts of Nature, I am referring to all living things produced by nature through countless past ages: from redwood trees to snow drops, from elephants and giraffes to hummingbirds and butterflies — and, I might add, from whales and walruses to starfish and sea anemones.

The Arts of Man need no special definition, except that at this moment I am thinking particularly of the *creative* arts — painting, sculpture and music.

A gulf, a vast difference, exists between the works of *nature* and of *man*. The former are totally irreplaceable; once gone — gone forever; the latter *can* be recreated even though in somewhat varied form.

These facts explain in part why our Zoological Society is so passionately dedicated to the protection of all forms of animal life. Once they disappear they will never exist again.

Another observation: In the modern world man is becoming more and more insulated from the wonders of nature. He is being deprived of the inspiration that alone can come from *natural* things. Of all Nature's riches, animals are the dynamic evidence of her processes; we sense this, almost blindly, almost instinctively. Animals represent a magnet to us that we cannot quite define — nor need we. Why else, indeed, are we all here this evening? Why else do some three million people come to our Zoo and Aquarium each year?

Allow me to express a feeling of deep restlessness. It is not *good* that man should be concentrating so greatly on his *own* powers; on his *own* capacities; on his *own* artifacts.

Outer space beckons and vast sums are expended in devising extraordinary instruments, created by man's ingenuity, for its exploration.

All the while, this is the planet designed for our survival; the only place we can expect to live upon throughout the long future — adorned, we may hope, with its natural riches and embellished by the arts of man. Could it be that we would

(Continued inside back cover)

DAVISSON
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After Four Months

RED LIGHT PAYS DIVIDENDS

By JOSEPH A. DAVIS, JR.

Associate Curator of Mammals

THE RED LIGHT ROOM of the Small Mammal House has been operating for four months (as of January 15) and we can report now on how the nocturnal species exhibited there have fared under their reversed day and night. A few of the animals — the bushbabies for example — have been living under what one newspaperman called “a topsy-turvy day” for almost a year, with no ill effects.

(It may seem odd to bring the matter of “ill effects” into this discussion — for we expected none. Still, we have been watching, as a matter of prudence.) There is a popular notion that we “trick” the animals into thinking day is night, and this perverse word has lurked in our minds all this time. Actually, far from producing any unwanted effects, the reversed day may really be beneficial.

Let's look at four of the species exhibited in the Red Light Room: the Silky Anteater, Indian Pangolin, African Palm Civet and Kinkajou; they illustrate two points.

Our Silky Anteater (*Cyclopes didactylus*), a tiny 18-inch-long creature, has been with us for 4 months, is apparently in good health and is well past the previous longevity record of 72 days. The smallest of the anteaters, *Cyclopes* is totally arboreal, living on tree-dwelling ants or termites, which it obtains by tearing open nests with its comparatively enormous claws. All mammals whose diet is made up principally of small insects are difficult to keep in captivity; it is im-

possible to provide natural food in sufficient amounts. An adequate diet of substitute foods has been worked out in zoos over the years, but there are two problems that must be overcome. The first is the difficult business of training a creature accustomed to lapping up quantities of tiny moving insects to consume a thick soup that does not look, taste or smell like ants. Most pangolins, anteaters and Aardvarks have been through this phase by the time they reach us; frequently, however, they have not been fed an adequate ration by their native captors, and the sooner they reach us the better is their chance for survival. The second hurdle is that of nutrition. Aardvarks and Giant Anteaters thrive on artificial food, but other anteaters and pangolins generally do not, possibly because their nutritional requirements vary from species to species. For this reason, when a new anteater or pangolin arrives we offer first the basic diet, and vary certain of the ingredients until the animal's weight, general appearance and behavior “look right.” The scientific approach plays a part here, but with these creatures we still have to rely heavily on hunches. To give an idea of how little science can help, this is what happened when we received three Indian Pangolins last April. We called a friend who is a professor of entomology at an upstate college, one of whose specialties is myrmecology, the study of ants. Armed with the knowledge of the country of origin of the pangolins we hoped to find out the kinds of ants inhabiting the region, with the intention of possibly adding formic acid to the diet to make it taste anty. We were told that all manner of ants were probably to be found in the area, some with formic acid and some without. After a lengthy

The baby Palm Civet is getting more active daily — “exercising” by climbing in and out of the hollow log in its compartment and climbing over the tree branches in a spasmodic, uncertain, babylike way.

conversation, all that could be said was that the matter of ant flavoring was still up in the air. We added cereal to the diet to provide the roughage normally represented by the tough cuticle of insect bodies. The pangolins seemed to do well, the two young ones nearly doubling their weight in 3 months. When the animals, which usually ate all the food put before them, began to look too plump, we offered less food until we hit upon a sustaining diet. Periodic changes in the animals' amount of activity require adjustment of the quantity of food offered, and the problem then settled into one of watchfulness. And this is where red light has proved a blessing. We can now see how active our animals are, because this activity takes place by day, when it can be observed. Further, we can now tell more about our animals as they move about. Curled up into a ball, an animal shows little of its physical condition. Now, should one develop an injury, we will be able to discover it easily. In addition, our ant-eating animals eat their food freshly prepared,

The most noteworthy thing about the Silky Ant-eater is that it is thriving under red light. As a rule, these tropical creatures are difficult to maintain. Ours has already broken the record.

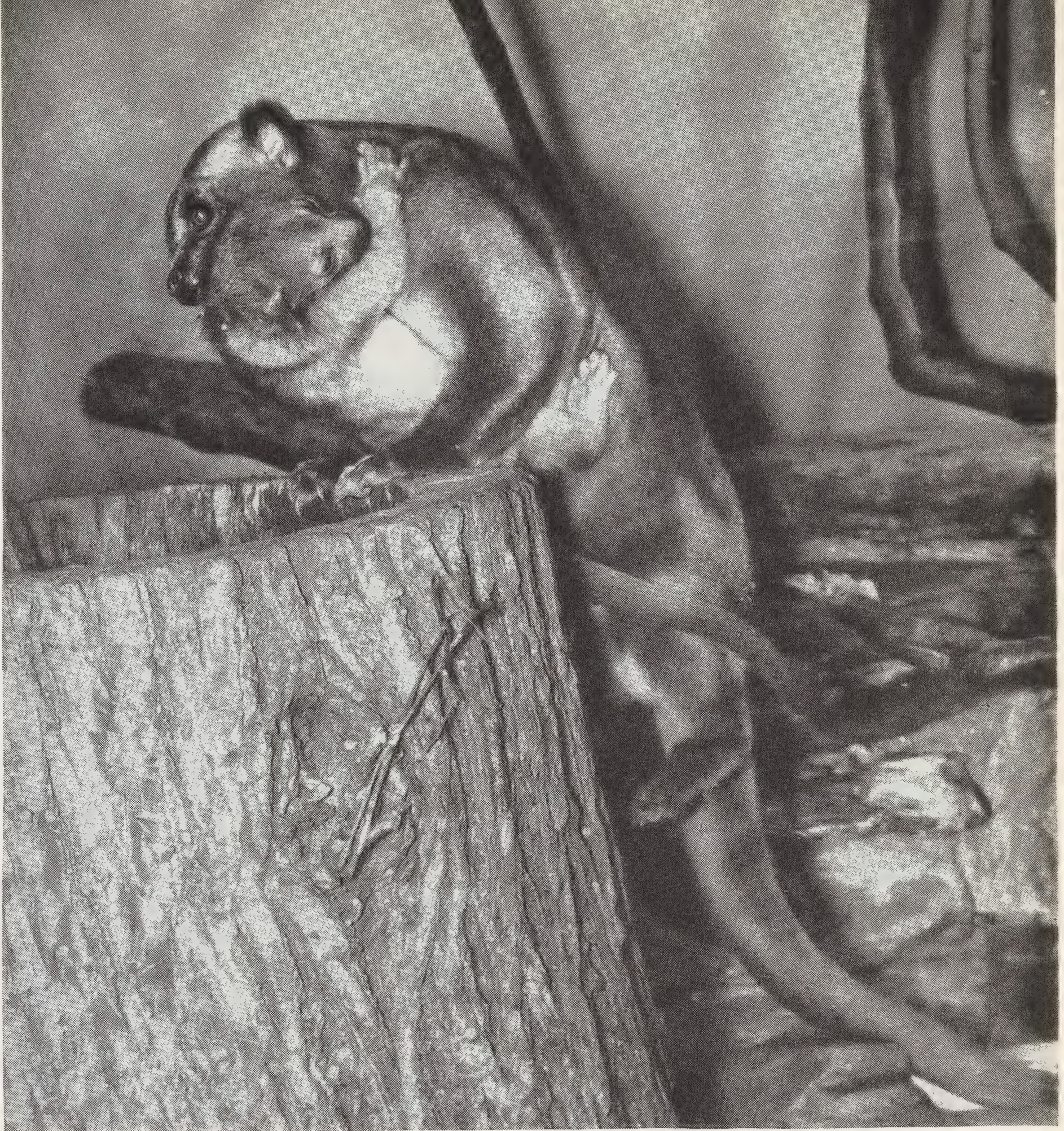
whereas formerly food mixed in the afternoon might go uneaten until nightfall, during which time it could begin to spoil. We know, too, that our pangolin regularly hunts the crevices of his enclosure for larval roaches, with which he supplements his diet, and we have discontinued the use of insect sprays, for fear of poisoning him. In short, we are in closer touch with our small mammals now and can better care for them — and of course, the public can see them, too.

It happens, then, that far from being detrimental to the health of our small mammals, red light exhibition actually provides indirect benefits to them. Perhaps more so than we are able to determine just now.

Since the red light room opened on September 15 two species — the Kinkajou and the African Palm Civet — have given birth, the first young the Small Mammal House has seen in nearly three years. The African Palm Civets were young animals when they came to us in June, 1960, and their breeding may be merely a reflection of maturity. Palm Civets do breed in captivity, and there is nothing spectacular about the birth, beyond its indicating that reversing the animals' activity has not interfered with their normal sexual activity.



Our Kinkajou baby's mother is so determinedly protective that for some weeks we had to close off the section where she and her baby are exhibited. In this picture she was carrying the baby out of the photographer's sight. She hid it until he went away.



The Kinkajous are another matter. Among the commonest and easiest to keep of small zoo animals, they almost never breed in captivity. No one knows why, nor have the few people who have bred them been able to say why theirs did breed. Three years ago we assembled a group of four females and one male in the Mammal House. Kinkajous are social by nature, and we hoped that living in a group might stimulate breeding. Nothing happened. We had five sleeping Kinkajous in our exhibit, where one or two would have been just as interesting (or uninteresting, since they slept all day). But we kept the group together, and when the red lights were installed we were rewarded by a show that was, if anything, a little too lively; the Kinkajous are so active and interested in their audience that they smear their glass cage front badly. In our eventual World of Darkness building, cages will be made smear-proof.

Just why the Red Light Room should encourage breeding (if indeed the case of the civets and Kinkajous is not simply coincidence) remains to

be answered. Certainly the redness of the light should have no effect — it merely happens to be a kind of light that appears dim to the animals and conveniently bright to humans. If the new regimen has had any effect at all, the reason could be this: that previously the animals' normal daytime sleep took place during the hours when their environment was filled with human noise, from keepers and public. Although it seems unlikely, perhaps they just never had an undisturbed day's sleep before. Now, of course, they sleep in a building empty of people.

The presence of people during the "night" period does not seem to bother them, and in fact many of them display an active interest in their public, now that they can do so during their normal hours of activity and free from the glare of white light.

The most popular exhibit, by the way, is not the rare and delicate Silky Anteater, nor the bizarre pangolin, but the flying squirrels, one of the commonest of our local species, normally hidden from view by the black of night.

HOW NESTLINGS DEFEND THEMSELVES

By ALEXANDER F. SKUTCH

San Isidro del General, Costa Rica

THE NESTLINGS of song-birds and other small birds are nearly always too weak and harmless to hold aloof the creatures that crave their flesh. While they are very young and sightless, the shaking of their nest, or almost any movement close above it, stimulates them to lift up their gaping mouths for food, just as they do when a parent arrives with a meal, and doubtless they greet in this trustful manner the snake or squirrel that comes to devour them. After their sight is well developed and they can distinguish their parents, the approach of a strange object causes the nestlings to crouch down in the nest and make themselves as inconspicuous as possible. They may clutch the lining of the nest so tightly that one who removes them for examination or photography must be careful not to cut their toes on the horsehairs or other fine strands from which he separates them. If feathered young have disappeared from the nest between the watcher's visits and he is uncertain whether they left spontaneously or were forcibly removed, examination of the lining will often provide the desired information. If it is pulled up, the young have probably



been torn away by a predator; if it lies flat, they have probably left spontaneously. But if the visits were widely spaced, there is a possibility that a building bird has pulled up the lining while extracting strands for its own nest.

Often, if one touches or even comes close to nestlings which have crouched down at his approach, they burst suddenly from the nest. At times a whole nestful of young birds leaves in this fashion, shooting off so swiftly in various directions that they seem to explode. Even if they can still scarcely fly, they flutter to the ground and hop rapidly away. If they are caught and returned to the nest, they often refuse to stay, but perversely jump out again as soon as they are released. Sometimes they can be persuaded to remain by holding a hand over them for several minutes, until they have become quiet, then gently withdrawing it. Although this is the most usual behavior, some young birds that are frightened prematurely from the nest, including hoatzins and anis, try hard to regain it when the alarm has passed.

In contrast to these small birds that shrink and



Above — A coral islet in the Caribbean where the author visited nesting Brown Boobies. One nestling made a vigorous attack on him. Right — Two of the little Boobies; the one on the left is the elder.

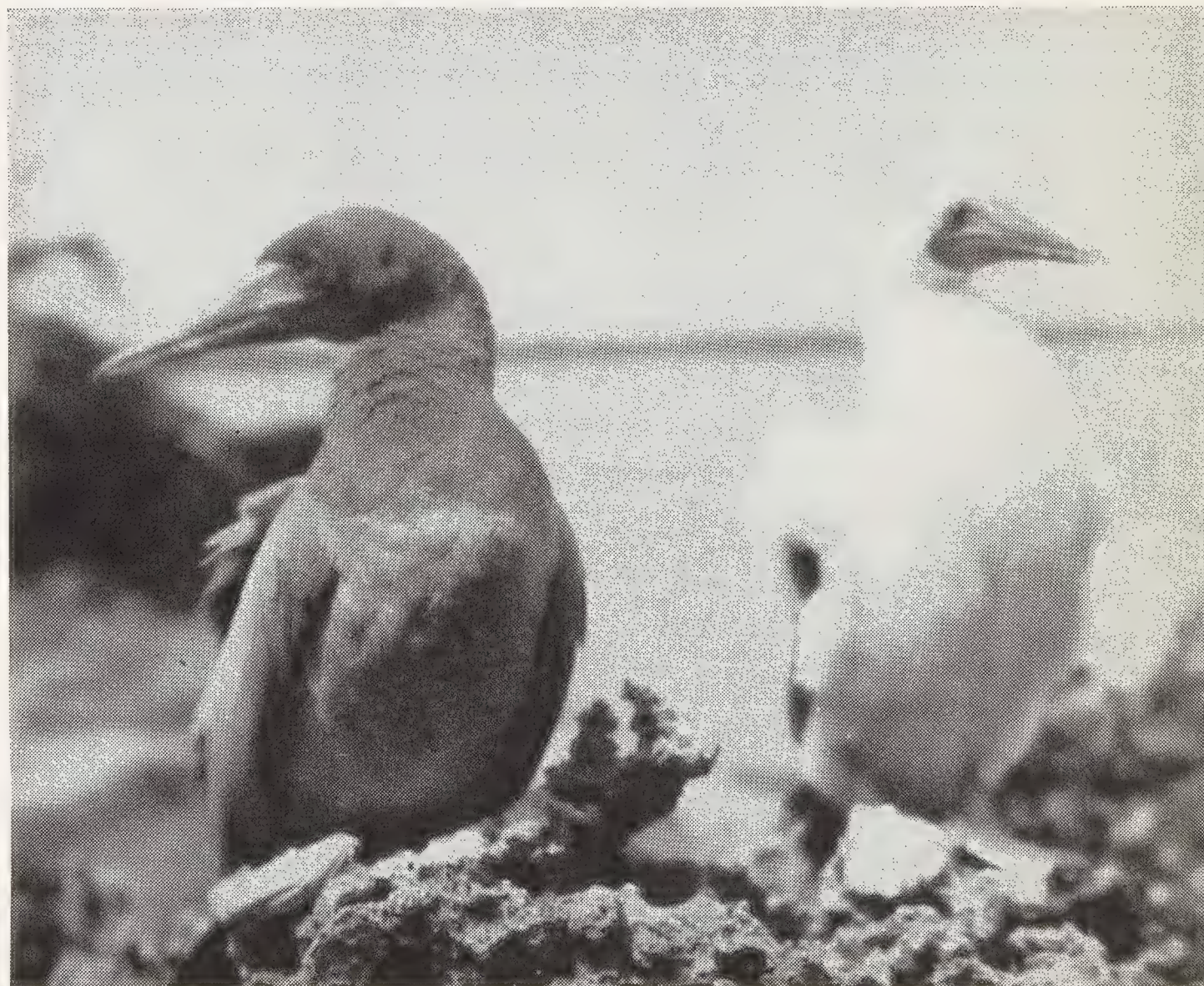
Both photographs by the author

flee, many larger nestlings stand their ground and fight. I was impressed by their ability to defend themselves when I visited a coral islet in the Caribbean Sea where Brown Boobies and Red-billed Tropic-birds were nesting. The young boobies rested in little circular areas devoid of the low vegetation which covered most of the rough, pitted surface of the coralline rock, with perhaps a stick or two that seemed to have been placed there as a token of a nest. Except two recently hatched nestlings whose parent stayed to guard them in the face of my intrusion, each youngster was alone. When I approached one of these larger nestlings, clad in thick, soft, pure white down, or perhaps with dark gray feathers already covering much of its body, it spread its wings and uttered hoarse cries while it backed to the farther side of its bare circle. As I came nearer the cry grew louder, until a continuous

ah-h-h-h poured forth from a mouth opened its widest, exposing the throat and the rudimentary pouch between the arms of the lower mandible. The downy youngster did not limit itself to vain cries, but with wings widespread and flapping it vigorously bit my hand, my arm, my shoe, or whatever else I presented to it. Sometimes, as the booby edged away from me, it came close to the downy occupant of a neighboring nest, who greeted it with pecks and bites that it returned in kind. When I saw that the boobies treated me much as they did each other, I felt less like an intruder.

The tropic birds nested on ledges and in niches on the steeper parts of the islet. Some of the young were already well feathered, and when taken in hand they raised deafening screams, at the same time attempting to bite and struggling so violently that I was glad to put them down again.

The only other nestlings that I have known to struggle as wildly and make as much noise as the Red-billed Tropic-birds are those of the Ringed Kingfisher, the largest member of the family in



the Western Hemisphere. When I examined a kingfishers' burrow with a single feathered nestling, it fled through the entrance tunnel and jumped into the river, where it spread its wings, turned upstream, and flapped its way slowly against the current. When it encountered ob-

stacles in the form of stranded branches, it hooked its bill over them and scrambled across. Although I pursued through the muddy shallows of the river, the flightless young bird managed to keep ahead of me until the great leaves of a fallen banana plant stopped its progress. When captured, it screamed loudly and tried fiercely to bite. For ten agonized minutes it resisted with all its might, but at last it became reconciled to me and perched on my hand until its feathers dried and I replaced it in the burrow.

Older nestlings of the colonial-nesting Black-crowned Night Heron defend themselves with their bills, which they direct against adults of their own kind who approach too near their arboreal nests of sticks. To avoid being mistaken for a stranger and treated accordingly, a parent arriving with food greets its young with an appeasement ceremony and recognition cry, which causes the nestlings to change from aggressive behavior to begging.

The nestlings of some of the larger pigeons have a number of mannerisms which seem to serve for their defense. Although the Scaled Pigeons spend most of their time high in the treetops of the tropical American forests, they often build their thin, open platform nests in tangled second-growth thickets, from two to fifteen feet above the ground. Here they usually lay a single white egg, at least in Costa Rica. When a solitary young Scaled Pigeon is disturbed, it rises in the nest, stretches up its neck, puffs out its breast, and lifts its wings, all of which make it look much bigger than it did while it rested quietly. In this attitude it sways upward and backward, downward and forward, with each forward and downward movement making a low clicking or clacking sound with its bill. As long as it feels itself menaced, it continues to perform rhythmically in this fashion.

The young pigeon's clack is produced by its mandibles in a peculiar manner. The lower mandible is pushed slightly forward, until its apex rests against the downwardly bent tip of the upper mandible. The bill is then slightly open. Apparently the two mandibles are pressed together by muscular tension until the lower one suddenly slips back into its normal position, and the two, striking together along their entire length, emit the sharp sound. The nestling also

darts forward to peck an intruding hand, and after its feathers begin to expand, it strikes with its wings. If taken in hand, it struggles vigorously without ceasing to clack its bill, and at the same time it hisses slightly. Doubtless all this bellicose display intimidates small mammals and possibly also snakes, yet some nestlings are taken by predators.

Older nestlings of the Red-billed Pigeon make a similar clacking sound with their bill, but not so loud as that produced by the Scaled Pigeon. They also strike and bite intruding fingers, but not hard enough to cause pain. The downy nestlings of owls hiss and clack their bills when disturbed and sometimes they fall on their backs to present their talons to the intruder.

Very different from the biting and striking of the foregoing nestlings is the method of defense of the young Fulmar. Although most members of the petrel family, to which Fulmars belong, nest underground in burrows, chiefly in the Southern Hemisphere, Fulmars lay their single eggs on cliffs above cool northern waters. On their seaside ledges the nestlings are exposed principally to the attack of aerial predators, such as Great Black-backed Gulls, Skuas and Ravens. When approached by a flying bird or even a human visitor, the Fulmar chick regurgitates an oily fluid which it shoots from its mouth toward the intruder with considerable force and often great accuracy. The spray from a fasting chick consists of oil alone, but if the nestling has just had a meal regurgitated by a parent, both oil and partly digested food may be ejected.

The studies of L. Harrison Matthews pointed to the probability that the ejected oil is secreted from glandular cells in the mucous membrane of the forestomach. That the oil is a true secretion rather than recently ingested food is evident from the observation of a bird-bander who picked up a Fulmar's egg that was on the point of hatching. The enclosed chick made spasmodic movements, chirped softly, and ejected a small quantity of clear yellow oil from its bill, which protruded from a narrow hole that it had just made in the shell. Obviously it had not yet been fed. Such precocious ejection of oil is, however, exceptional.

To defend itself against a bird that would snatch it up from the air, the young Fulmar must act quickly. Hence it shoots out its protective

With wild struggles and a great deal of noise the young Ringed Kingfisher defends itself. This one jumped into the river when Mr. Skutch examined its burrow.

Photograph by the author



fluid without pausing to consider whether the approaching object is bird or man, friend or foe. As Eric Duffey observed, even its own parent arriving incautiously may receive the oily spray. The chick defends all the space, above and around itself, within a radius of two or three feet from the point where it rests, and to avoid a hostile reception the parent alights at the edge of, or beyond, this defended territory. The parent cackles, then approaches cautiously, stopping if the youngster shows signs of alarm, to advance with more cackling when it calms down. Finally it reaches the chick's side and nibbles the down on its forehead, face and neck to stimulate it to take food, for which at first it does not seem eager. The nibbling is succeeded by bill-fencing between the parent and chick which resembles two people rubbing noses; then the parent opens its mouth widely and regurgitates to the chick. In its third week the chick recognizes almost immediately its approaching parent, who need now exercise less caution to avoid an oily reception.

The same method of defense is used by the nestlings of many small petrels and certain albatrosses, including the Wandering, Black-footed and Gray-headed. The adults of these albatrosses and the Fulmar either do not spit oil, or they

shoot it less forcefully and accurately than their chicks. Since they can escape by flying, this method of defense is less necessary for them. Possibly the habit of spitting at an intruder evolved from the reaction, widespread among sea birds, of regurgitating food before taking flight when alarmed.

The only land birds known to defend themselves by a liquid volley are the hoopoes and the related wood hoopoes, all of which are confined to the Eastern Hemisphere. When disturbed in their hole in a tree, stone wall or bank, nestling hoopoes first hiss or huff. If further annoyed, they turn around, scuttle across the floor of their nest, and press their breasts against the rear wall with their tails spread out over their backs. Then they discharge a foul-smelling fluid which consists of their excrement mixed with a stinking secretion of their preen gland. The female parent has similar methods of defending herself when cornered in the nest. She huffs violently and discharges a dark, musky liquid at her persecutor.

Many parent birds defend their nests more actively with their bills or feet, or else they try to lure the intruder from their eggs or young by fluttering away as though crippled and unable to fly. But that is another story.

Controversial, to Say the Least - -

AUSTRALIA'S WILD DOG

By DAL STIVENS

Sydney, Australia



Many Australians hate the Dingo, probably because it has a bad reputation as a sheep-killer. On the other hand, it may not be as destructive as it is said to be — and it is certainly a handsome animal.

Australian News & Information Bureau Photo

FEW IN AUSTRALIA love the wild dog. Call an Australian a “Dingo” and you’re in trouble. The name is a synonym for slyness, cunning and cowardice. “[When] a pure dingo comes close you can then see the treacherous, deceitful look, with the two sharp-pointed ears set to catch the least sound,” wrote a renowned trapper of the Australian wild dog in a booklet he published.

Dingos are hated with a vehemence that people in other lands have for jackals and coyotes and which I have always found puzzling. There is something atavistic about it, as though some race memory, perhaps of wolves, was stirred.

It is true that dingos are cunning — at least, the old ones, which have survived poison baits, gin traps and bullets and have become wary from experience. But there is no evidence that they are cowards.

Only the Australian aborigines have any love for these pariahs of the wilds, which they use in their nomadic hunting. Aborigines catch Dingos when they are young and train them. Unweaned puppies are sometimes suckled by native women and the wild dogs grow up with a lasting devotion to their foster mothers.

For many years the origin of the Dingos was a hot scientific debate. Were they indigenous to the continent? The discovery of Dingo bones with those of long extinct marsupials seemed at first to support the idea that the Dingos were here in early times and before the aborigines. But today it is believed by some that they evolved from a domestic version of the Asiatic wolf — or less likely from the Dhole (Indian wild dog) — and that they were brought to Australia by the



aborigines during one of their earliest migrations.

They stand about two feet six inches high and measure about five feet from snout to tail-tip, the size of an average collie. They have coarse hair with grayish under-fur. Their color ranges widely from light red to brown and black and the belly is always lighter. The tip of the brushy tail is often white; the ears are short, erect and broad at the roots.

The popular belief that Dingos are always yellowish-brown has led to a widely-held error that few pure-bred Dingos now exist in Australia and that the wild dogs are now mainly crosses with domestic dogs, particularly the Alsatian.

Thus any wild dog with blackish-brown coloring is automatically assumed to be a cross with the Alsatian. Such brindling occurs naturally. Early explorers and settlers have left accounts of seeing yellowish-white, piebald and blackish dogs. Albino Dingos occur, and there is a whitish race in southwestern Australia.

Dingos do, however, mate with domestic dogs and some crosses from wild mothers have been notorious sheep killers. On the credit side, as it were, is the famous Australian sheep dog, the

The Pintubi aborigines of the Northern Territory of Australia capture and tame young Dingos to aid them in their hunting. However, the dogs are said to revert to the wild state when about 18 months old.

Australian News & Information Bureau Photo

kelpie, a collie-Dingo cross bred back to collie. The blue cattle dog or Queensland heeler has a similar origin.

Dingos are, in fact, handsome animals if you can regard them objectively. And they are efficient hunting machines, following by scent, working in silence, slipping along with effortless ease on tip-toes. They are swift killers. Their powerful jaws can tear away the flesh when the teeth snap and shock a kangaroo to death. Or they can snap the animal's backbone as easily as you break a twig.

IT IS UNLIKELY that Dingos made their way unassisted to Australia. The first route could have been along Antarctic land bridges that possibly existed; the second route would have been through lands connecting Australia and Asia. None of these land bridges were continuous but were subject to intermittent rising and falling. And in the north, from late Pleistocene times, rafts would

have been necessary for the crossing. The absence of Dingos from Tasmania rather disposes of the Antarctic theory.

The second possibility is discounted by the almost complete absence in Australia of other Asiatic non-marsupials which could have been expected to have made the journey also.

When the first explorers and settlers saw Australia, Dingos were widely established. The first record is that of the Dutch sea captain Jan Carstenz who in April of 1623 observed on the eastern shores of the Gulf of Carpentaria the tracks of a large dog (and a man).

It is maintained but not established that "Dingo" may not be the name used by the Sydney tribes of aborigines (to whom it is often attributed) but the contemptuous name given to the settlers' European dogs. "Warrigal," another term of fairly popular usage in Australia, was used by aborigines further inland. It is applied now to wild creatures generally, including aborigines.

The scientific name *Canis antarcticus* has superseded the former *Canis dingo* Meyer, 1793. This was based by Robert Kerr in 1792 upon a reference and drawing of the Dingo in *Voyage of Governor Phillip to Botany Bay* (1789).

It is possible that Dingos did not unduly disturb the balance of nature after their introduction by the aborigines. They were probably responsible, however, for the destruction on the mainland of the marsupial wolf, or Thylacine, which was confined to Tasmania at the time of white settlement.

It has been suggested that the numbers of Dingos increased after settlement and the introduction of sheep and cattle. They were once widely dispersed all over Australia, in open plains as well as in forests. In closer-settled areas today they are more numerous in hilly timbered or scrubby country which provides cover.

Any estimate of the Dingo population is necessarily hazardous in so sparsely settled land as Australia, with an area about as large as the United States but with only 10,000,000 people and half of these in the capital cities and most of the others within a few hundred miles of the coastline. Some estimates put the Dingo population at about 200,000.

When the white man cleared the land and

destroyed the Dingo's native game, the wild dogs took to raiding sheep and the sheep farmers struck back with traps, poison and bullets. There is a typical account of eighty years ago of a man losing a horse and poisoning the carcass. One hundred and forty Dingos were discovered dead. A naturalist of the day averred that there were no great numbers of Dingos left. "They have been killed off in thousands by the agency of meat poisoned with strychnine," he wrote. "The Dingo will be extinct in a few years."

There are Dingos still in mountain country within one hundred miles of Sydney. On cattle ranches 200 miles north of Sydney, Dingos still survive after 160 years of persistent warfare.

That so little is known about the natural history of Dingos is because of the difficulty of observing such cautious and wide-ranging creatures. Indeed, the Wildlife Survey Section of the Commonwealth Scientific and Industrial Research Organization has had to postpone its program of tagging studies because of the practical difficulties of live-trapping Dingos. Most observations have been of isolated animals, and many of these were made not by naturalists but by pastoralists whose major interest in the Dingo was its extermination and not its habits.

My own observations of the Dingo, and those of some keen-eyed Australian bushmen with whom I have talked, lead me to think that Dingos may have a territorial system, particularly when breeding, and that the male marks the area by urinating on bushes and logs. The "scent posts," as Dingo trappers call them, are presumably warnings to any strange wild dog which enters the area. The male Dingo selects a mate when he is two or three years old.* His mate bears a litter of five to eight pups in the early spring or late winter after a gestation of nine weeks. A number of lairs may be prepared in high country where the female can keep watch and move the litter if danger threatens. Dingos rear the family in a cave, a hollow log, or an old rabbit warren, close to water and to a food supply.

The female nurses the pups for about two months before they are weaned. Later the family hunts as a team until the youngsters are about a year old. But there are instances of the offspring

* Dingos in the Zoological Park have recently produced young in their first year.

tailoring along with their parents for a couple of years before leaving the parental territory and seeking mates. There are some reports of litters being cared for mainly or possibly entirely by the female.

Where they are not molested by man, Dingos hunt mainly by day and lay up during the mid-day heat. In closer-settled areas, their hunting is often nocturnal. They like to move along valleys and follow pads made by other animals such as sheep and cattle.

Dingos do not bark, but utter yelping sounds which merge into a mournful and eerie howl. A Dingo howls when approaching its lair, presumably as a signal. A Dingo that has become separated from the others will find them by howling at intervals and moving towards the answering wails. Some howling, particularly at nights, may be a territorial proclamation. I have heard it accompanied by the sound of what appeared to be savage snarling and fighting. Professional Dingo hunters (called "doggers") have told me of "sounds of desperate scrapping and fighting at night."

In the Zoo — if not in Australia — Dingos are regarded with affection. They breed freely in captivity, so that the problem is how to dispose of the pups to other Zoos. We generally have a surplus.

Dingos are not particularly fast; they can run perhaps 30 miles an hour. Sometimes they will run down a young kangaroo or emu in a straight chase, but it is usually the family's teamwork that scores in circling and harassing a mob of kangaroos — or sheep — until the weaker drop behind, exhausted.

Sometimes a kangaroo at bay will turn and take a stand against a tree, leaning its weight on its thick tail. When the wild dog leaps for its throat the kangaroo will clasp it with its forelegs and rip with a sharp toe from throat to crotch. Or the kangaroo may take to water up to its armpits and drown the dogs, one by one, as they swim in to attack. Wallabies, which are slower and live in hilly country, will sometimes make a stand on a cliff and try to hurl the attackers over the edge.

A pair of Dingos attack an animal simultaneously, one in the rear and another flying for the throat.



John Bacon, a retired grazier (sheep farmer) and an expert "dogger," has told me of seeing three Dingos slay a two-year-old steer. Watching from a mountainside, he saw them cut it out from the herd and chase it onto open country, keeping behind it all the time and biting its legs. The steer was dead from a dozen slashes in the throat before Mr. Bacon could ride down to the spot.

Such an attack is somewhat out of the ordinary. Dingos will usually single out a weak cow or try to lure a calf away from its mother. A pair will sometimes use what might be called a "soft" approach on a cow and calf away from a herd, moving around like playful pups and trying to

get the calf away. They will persist in these tactics for hours. They are cautious of the horns and hooves of cattle. When they try a tougher line, they nip the heels of cattle and crouch to let the flailing hooves pass overhead — a technique also useful in evading the steely-muscled legs of kangaroos and emus.

Dingos also hunt rabbits, bandicoots, wombats, echidnas and ground birds. They will rush an echidna on the move, upend it and tear the belly open. If the echidna starts to dig in, hungry Dingos press home the attack, biting through the sharp quills.

Dingos avoid man — which is just as well for man. A Dingo family would be a formidable hazard in the Australian bush.

Man aside, the Dingo has few enemies. They include the Wedge-tailed Eagles, pythons, carpet snakes and crocodiles in the tropical regions. The Wedge-tailed Eagles, one of the world's largest, take a big toll of young Dingos. A pair has been observed to kill a full-grown Dingo, but this is almost certainly exceptional.

There is evidence of regular migrations by Dingos. They mainly move towards the eastern coast in winter and move out in the summer. Mr. Bacon noted a twice-yearly migration of Dingos in the New England region of New South Wales. They used to come up the coastal side of the 5,000-ft. Great Dividing Range towards the end of April (autumn) and again towards the end of November (early summer). Mr. Bacon first noticed these Dingo routes or leads in 1900, and they were in constant use, in his experience, up to 1935. He established that they were still in use in 1950.

The late Charles Blair, former Vermin Control Officer for the Western Australian Government, considered there was strong evidence that many Dingos bred in the Warburton Ranges in the center of Australia and migrate regularly across some hundred miles of the treeless Nullarbor Desert into the south-west areas of Western Australia. He was of the opinion that these migratory trails are thousands of years old.

He also thought that the dogs may migrate in

other directions from their Warburton Ranges breeding grounds — perhaps into South Australia and into the northwest.

The Dingo is generally regarded as killing sheep wantonly from an excited blood lust. Certainly a family of Dingos will frequently race round a flock at night, slashing at their throats, tearing at their flanks, until fifteen or twenty have been slain and perhaps as many more maimed. It is possible that sheep do excite the Dingos, but some of the carnage is almost certainly due to the inexpertness of young Dingos.

Dingos are estimated to slay many thousands of sheep each year in Australia — most of them in the sparsely settled areas of Queensland, the Northern Territory, South Australia and Western Australia where rainfalls are sparse and the country carries one sheep to ten or even fifty acres. Here holdings are necessarily huge and a property the size of an American county may be cared for by a handful of men.

Queensland has now completed a 3,000-mile-long 6-ft.-high, Dingo-proof fence to enclose about 80 per cent. of its sheep country. The cost was £12,500,000 (\$28,500,000) but sheep losses from Dingos can be expected to decline.

Thousands of Dingos are destroyed each year in Australia. Bonuses paid for the scalps by Government agencies have been fixed at \$7 for an undistinguished Dingo. For the uncommon Dingo that has made its mark as an accomplished killer of sheep or calves, the blood money might range up to \$300.

The "rogue" Dingo is often one that has been crippled by a bullet or a trap, is unable to run down his bushland game, and turns to sheep. Sometimes he turns out to be a crossbreed, like the Yengarie (Queensland) "Lion" of 1946 which was hunted to his death and found to be a Dingo-collie cross.

What does the future hold for the unique wild dogs of Australia? It is hard to say, but naturalists hope they will be preserved in areas where they do not clash with man and where they can carry out their essential role in that great interdependent mechanism — the balance of nature.

Pictures by Emmy Haas.

She's a WEEK-END PHOTOGRAPHER

OUR PHOTOGRAPHIC LIBRARIAN was turning through a stack of Emmy Haas's prints one day when the phone rang.

"Can you tell me, please — when's the best time to photograph the animals?"

"Just a moment." The Librarian glanced at Miss Haas. "When do you take *your* photographs?"

"Oh, the only time I have — week-ends and holidays."

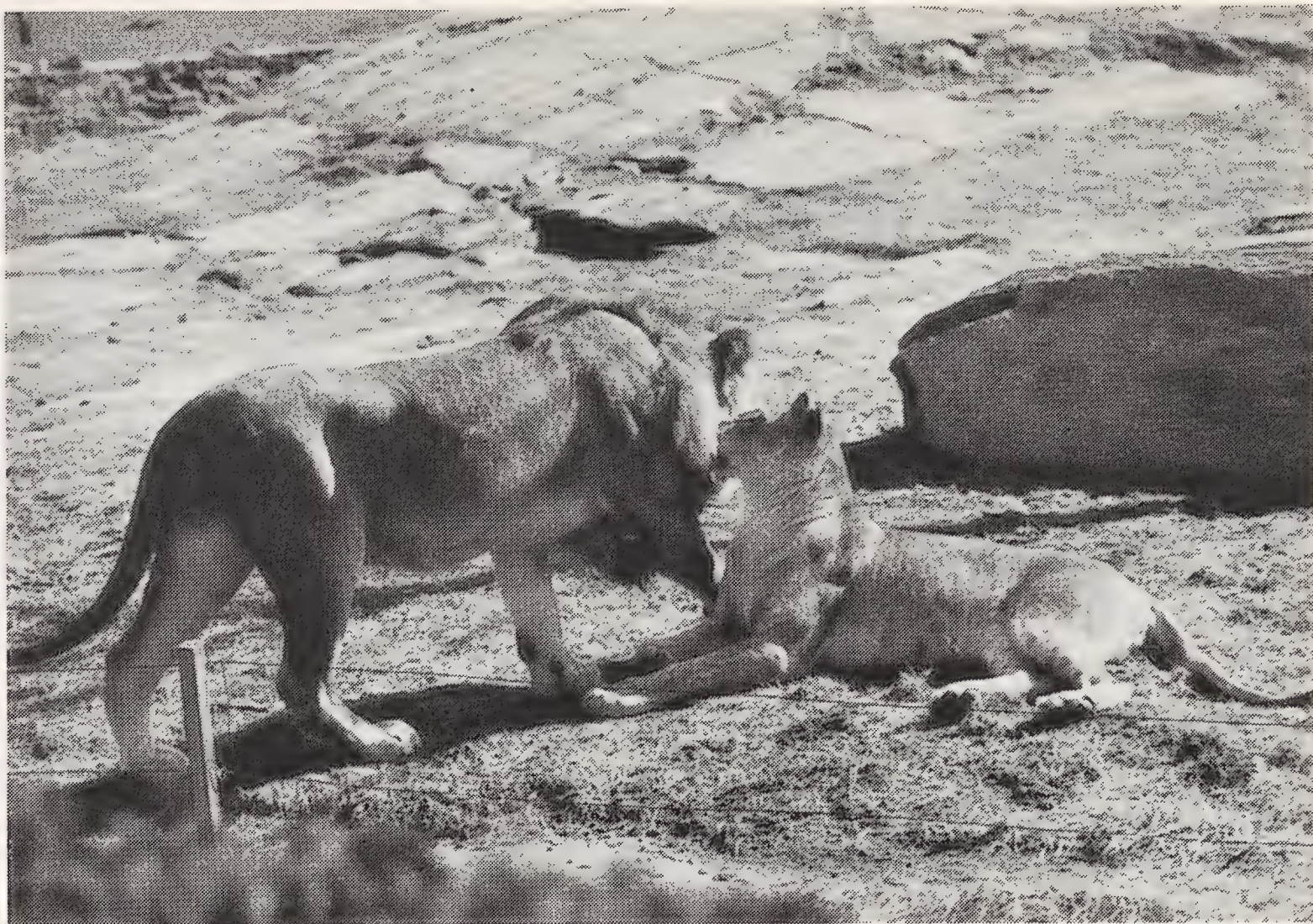
Back to the phone: "I'd say the best time to photograph the animals is the week-ends and holidays!"

But Monday-through-Friday are equally good if you have Miss Haas's eye for composition and expression. On this and the next two pages are some of her week-end pictures made at the Zoo and the Aquarium. Although she is a Member of the Zoological Society and could call upon the staff's friendly services to aid her in "setting up" certain pictures, she never does so; she likes to wait and watch by herself. Some days she may take a dozen shots, on other days none. "It all depends on whether the picture looks good to me." She uses a Nikon F prism reflex, medium-speed film, and generally shoots at 250th of a second. Miss Haas will be remembered for her delightful studies of "Ookie," the Aquarium's young Pacific Walrus, which appeared in *Animal Kingdom* and, on two occasions, in the *Illustrated London News*.

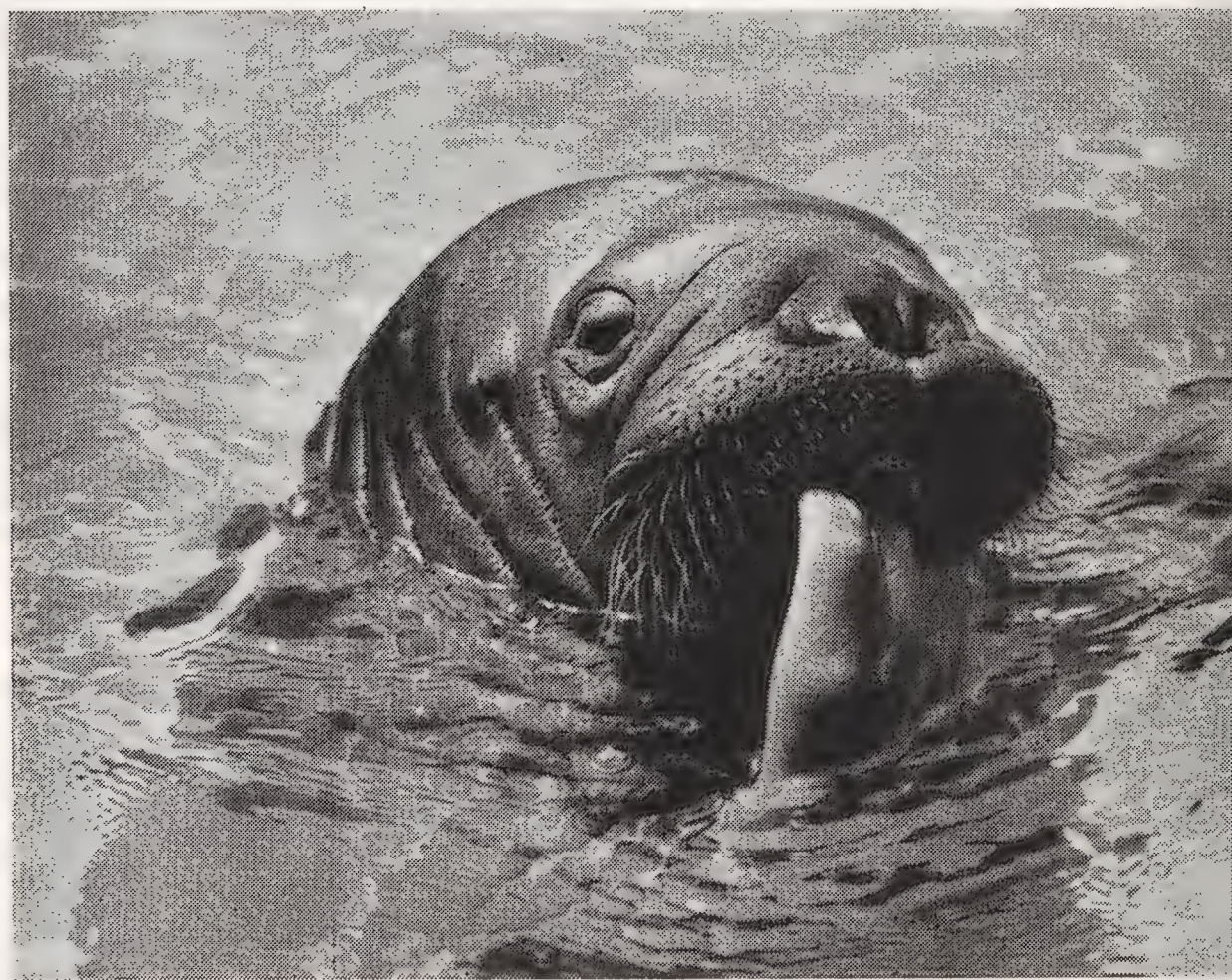
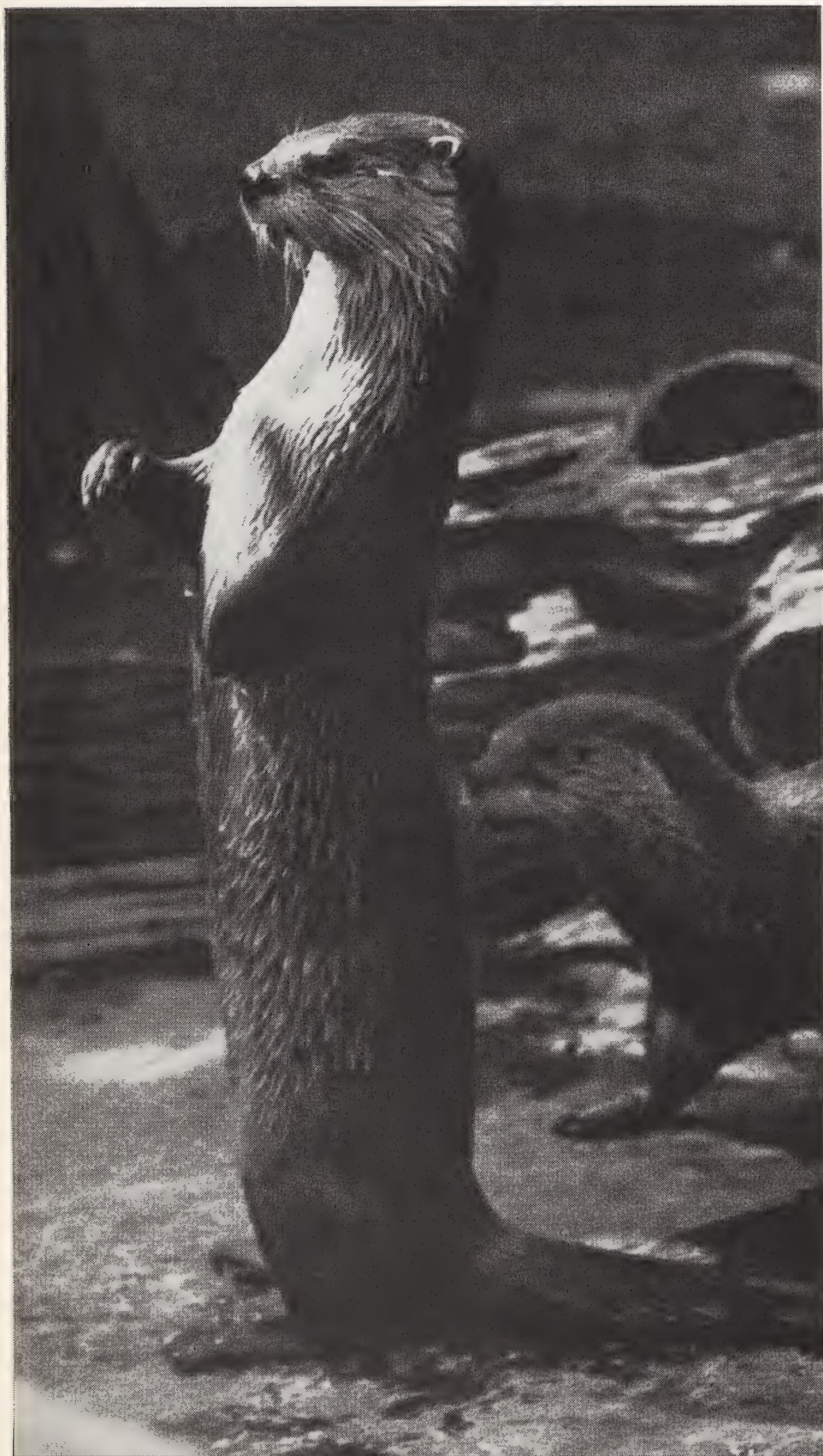
PENGUIN PARADE AT THE AQUARIUM



**BY-PLAY ON THE
AFRICAN PLAINS**

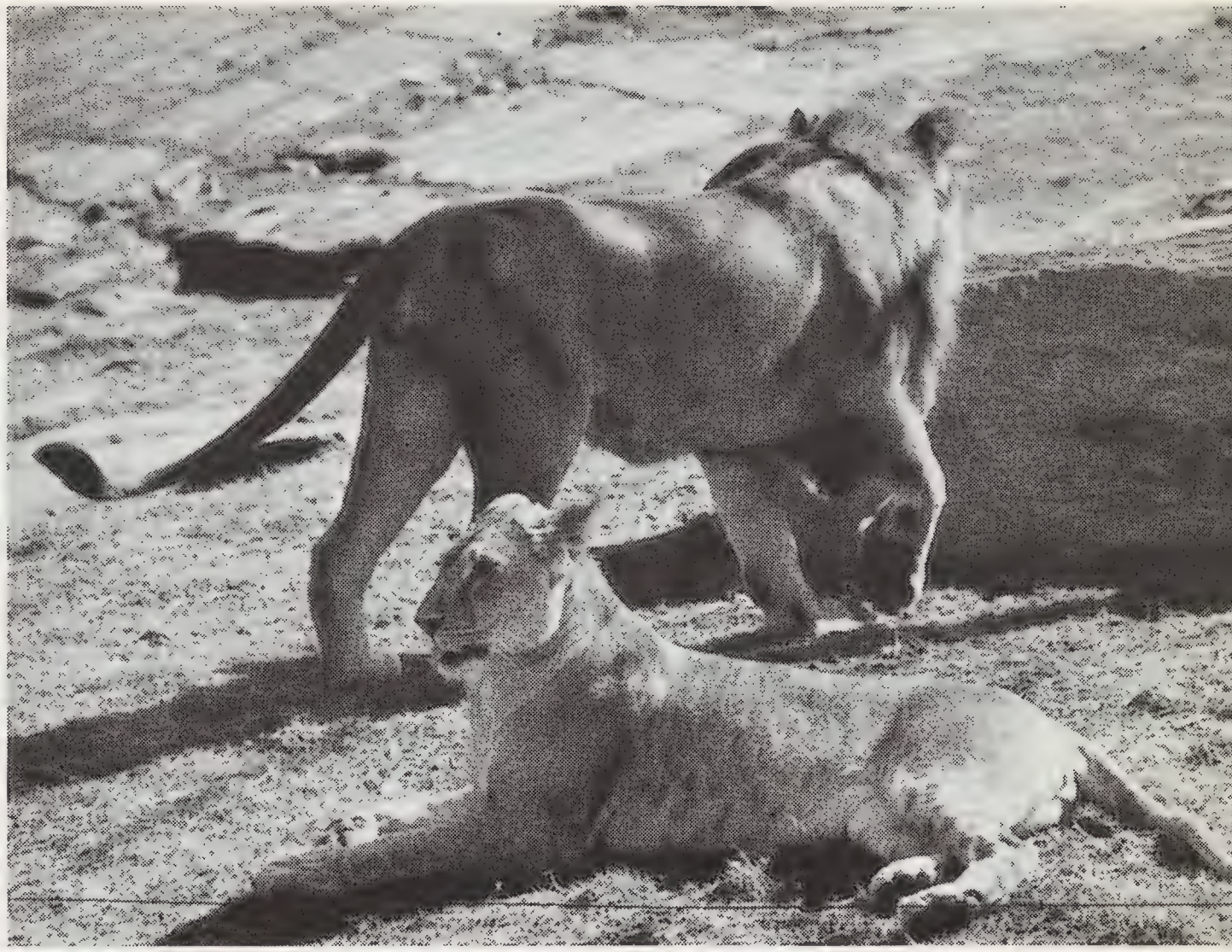
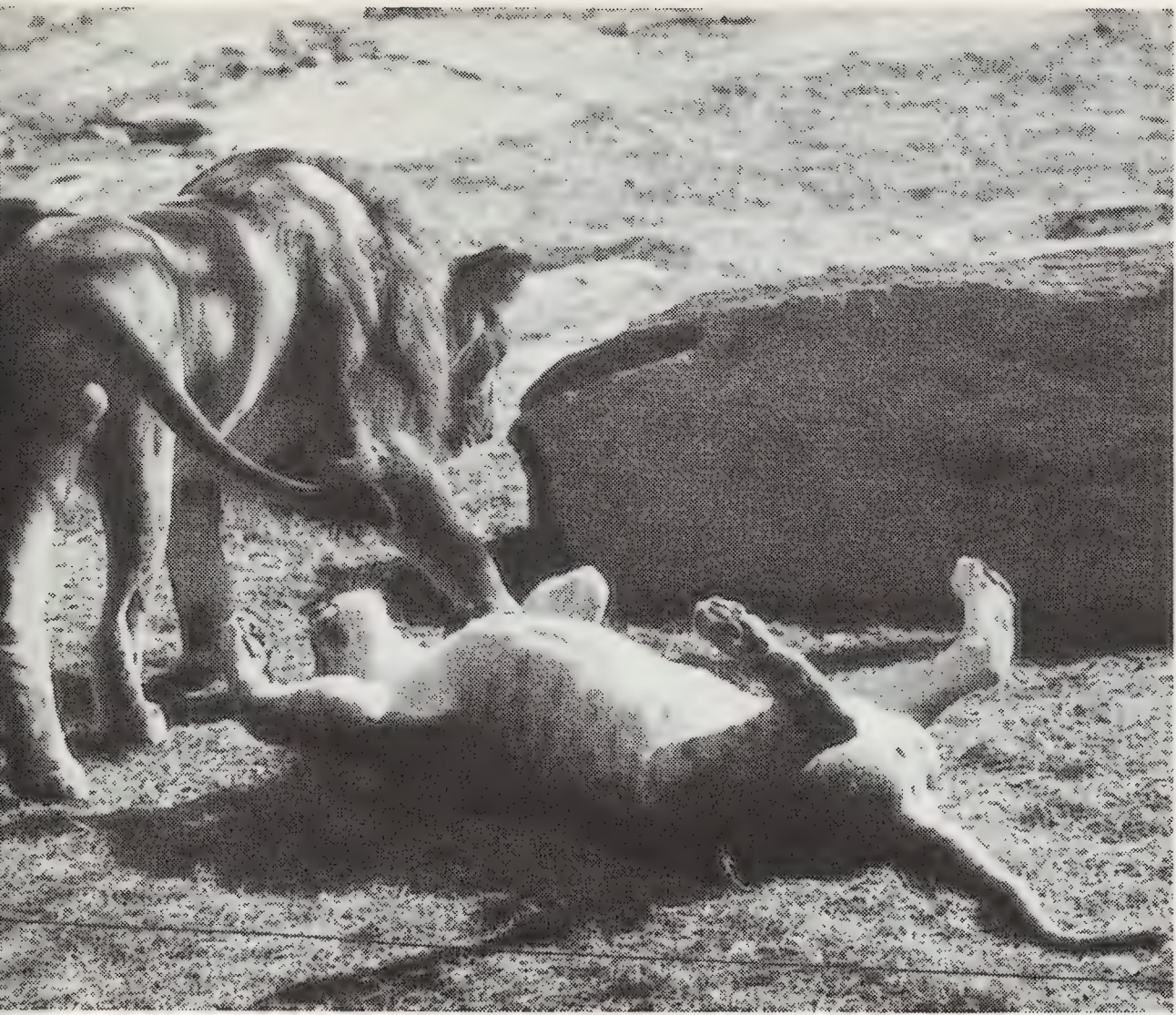


**“UP PERISCOPE!”
IN THE OTTER YARD**



**BABY WALRUSES,
TIPIK AND SEEKU,
SUCK THEIR FLIPPERS
LIKE ANY OTHER BABIES**





**GIBBON MOTHER
AND BABY**





We're Learning Things about

NORWEGIAN LEMMINGS

By OLAVI KALELA

Associate Professor of Zoology, University of Helsinki

I FIRST MET the Norwegian Lemming (*Lemmus lemmus*) in the spring of 1946. I was told that Lemmings were moving in the most northwesterly part of Finnish Lapland, in a fjell region exactly where the Swedish, Norwegian and Finnish frontiers met. On that occasion I arrived too late; I saw the Lemmings at their breeding sites but migrations had ended. Since then I have spent part of almost every summer in that very region. Lemmings, however, were extremely rare up to 1959, but in the autumn of that year local migrations took place both in

northwest Lapland and elsewhere. But the Lemmings moved only at night and it was difficult to observe their behavior, although it was fairly easy to collect animals for study.

Only in the spring, when the Lapland sun never sets, are migrating Lemmings easy to watch, and when the message reached me on May 14, 1960, that the animals were again in movement in northwest Lapland, my co-workers and I hurried to the place as quickly as possible. The first member of our expedition arrived there on the evening of the 16th.

Spring was early that year and the birch stands on the fjell slopes were free from snow, but in the alpine zone, which begins at about 2,000 feet, there was snow in plenty and the big Kilpisjärvi was hard frozen.

The Lemmings migrated across the ice of Lake Kilpisjärvi. They could be studied from most of the ground covered by our daily trips and even from the window of our lodgings, which had an unobstructed view across the lake to the Swedish coast two miles away. This time we had been lucky but our good fortune did not last long. The migration was apparently already slackening on our arrival and ceased almost entirely within eight days.

I believe that many biologists have had similar experience of Lemmings. It is extremely difficult to predict where and when the animals will move. In the spring of 1960, for example, my co-worker Mr. Johan Tast had been waiting in vain for

migration season in the spring is usually very short, and coincides with a sudden phase of snow-melting. The other annual migration season is admittedly usually long, often lasting from late summer until the snow falls, but darkness hampers attempts to find out what actually happens in migrations.

The local population, Lapps and others, offer fantastic explanations: Lemming hordes emerge from the Arctic Ocean to disappear in the Atlantic; they travel in a straight line, preferring to perish rather than to go round a building, and so on. Many popularly-held beliefs and even some scientific works confirm the idea that Lemming swarms may plunge senselessly into the ocean or over steep precipices. It is generally assumed that all the wanderers perish by various accidents or are chased by the numerous predators that follow them.

What our expedition, composed originally of Miss Aila Kokkonen, Miss Terttu Koponen and myself, witnessed in the spring of 1960, was not nearly so dramatic. Many hundreds, perhaps thousands, of Lemmings moved on the ice of Lake Kilpisjärvi. Each animal moved remarkably directly, most of them northward or northwestward. There were, however, many exceptions to this rule, and no swarms were involved at all. On the contrary, the animals seemed to move completely independently of one another, and towards the end of migration period there were usually only one or two Lemmings visible simultaneously on the ice of the open lake.

Frequently one of the Lemmings would come across the ice from the Swedish coast straight towards our house, where the ice was separated from the shore by a channel of water approximately 15 feet wide. Time after time the Lemmings ran, for minutes on end, back and forth along the edge of the ice. Some of them swam across that narrow stretch of water; the majority ran along the edge until they found a place where they could reach the shore without going into the water, and a few even turned back, although they can swim well, even over great distances, in calm water. We witnessed this in the autumn, but even then the animals by no means flung themselves into the water. Instead, they went in carefully after some hesitation. In spite of their powerful migratory drive, which compels them to

Left — Lake Kilpisjarvi in Lapland, where Dr. Kalela and his associates studied the movements of the Lemmings. Below — Adult Norwegian Lemming.

Photos by P. Korhonen and S. Sorjonen



Lemmings since the beginning of May in an entirely different part of Lapland from the Kilpisjärvi region, but one where they had occurred in the autumn in even greater numbers. And even though one may manage to be in the right place at the right time, there are other difficulties. The



cross frozen areas and waters in their direction of movement, the Lemmings in so doing nevertheless adapted themselves with considerable flexibility to the changing conditions. Our observations even suggest that they did not cross the frozen lake surface haphazardly but headed for some distinctly discernible point along their main course on the opposite shore.

These animals, something between a mouse and a rat in size, did not move very fast; in any case, many of them could be overtaken as they were running on the open ice. When the pursuer came close the Lemming would turn round and, lying on its back on the ice, begin to utter hoarse cries. If provoked further it kept moving sideways or made dashes, quick as lightning, towards the pursuer, often even leaping in the air. It could bite an outstretched hand rapidly, but soon reverted to its crying. In the middle of its aggressive behavior, however, the animal would suddenly turn round and try to escape.

This is the way in which many Lemmings behaved even when surprised on land. A Lemming in the forest might attack a man who had not even noticed it, and thus create the impression that it behaved "stupidly." Cases like this have doubtless confirmed the view that the migrations, from the individual Lemming's point of view,

are radically non-adaptive and that migrations occur only to check the population's too rapid growth. The migrations probably do have this effect, but we are not at all convinced that aggressive behavior is non-adaptive from the individual Lemming's point of view. Observing Lemming migrations in the spring (as also in the spring of 1961) and in the autumn, we have found several individuals killed by predators. On the other hand, we have seen how the Hooded Crow (*Corvus cornix*) and the ermine, for example, have allowed themselves to be bluffed by the Lemming's aggressive behavior, and have left their prey in peace. It was surprisingly rare to see a predatory animal harass the Lemming on the ice, even though it was much more visible there than on snowless ground.

After the spring migration of 1960, there were many Lemmings in the Kilpisjärvi region and the population grew rapidly during the summer. We caught large numbers of them from breeding sites, where they showed no aggressive behavior and led a generally unremarkable existence. In the latter half of July, however, Lemmings again began to be on the move. A new migration season had started — remarkably early that year — and movement continued until the snow fell early in October.

Attention is generally attracted to the Lemming's autumn migration as drowned animals are seen on lake shores. In the autumn of 1960, it was not unusual to find 50 to 80 drowned Lemmings if one walked half a mile along the shores of Kilpisjärvi. During the migration season they drowned by the thousand. Do Lemmings move in swarms in the autumn and do they then dash heedlessly into water?

At the end of July, nights in Lapland are still light enough to allow fairly easy observation of wanderers. Dr. E. A. Lind was the first to notice that Lemmings liked to run along paths made by reindeer or man. After dusk we could watch migration along a path that ran quite close to our lodgings. Lemmings came one by one, at intervals

Left — The ice was breaking up on Lake Kilpisjärvi in mid-June. It was here that the Lemming studies were conducted. Thousands of the little rodents were lost by drowning at the peak of emigration.

Photographs by the author

of a few minutes while the movement was at its steadiest. Nearly all the animals headed in the same direction. Sometimes they stopped to eat sedge or moss by the way. It was here we once saw how an ermine, advancing along the path, left alone a furiously aggressive Lemming at the side of the path.

The path remained in use until the end of the migration period. We, however, were interested in seeing swimming Lemmings. Lake Kilpisjärvi, about ten miles long, is in two parts, divided by a sound 300 feet wide. At this point plenty of Lemmings swam over and the wake of a swimming Lemming on a calm water surface was easy to see even in darkness. The direction of migration was again remarkably uniform — even more so than in the spring; nearly all of more than a hundred Lemmings seen here by Messrs. Jorma Aho, Arvo Myllymäki and Johan Tast during three nights came from the Swedish side and swam at a slightly oblique angle towards the Finnish shore. In some cases it was possible to see in detail how they entered the water. Having run for some time along the shore and come to the tip of some small peninsula, they carefully descended into the lake. Once in the water, they swam with determination in the predetermined direction. If a man met them on shore, the Lem-

mings might utter an aggressive cry while still in the water, but only exceptionally did one turn around.

The circumstances in which Lemmings drowned were not directly observed. In calm weather some were seen swimming along much bigger stretches of water than the sound mentioned above. Experiments showed that the Lemming, unlike many other rodents, cannot dive, and that it is obviously helpless even in relatively small wavelets. Those dead Lemmings carried on the waves to the shore near our house had probably started their water journey from many widely different parts of the long coastline of Lake Kilpisjärvi. Even they are no indication of migration by swarms.

Where do the Lemmings come from, why do they migrate, and do they all perish during migration? These were the main problems which our expedition tried to elucidate. Studies were carried out during the snowless period and sometimes also in winter, over three years: 1959, when the Lemming population was fast increasing; 1960, when the peak was reached in most of the Finnish fjell regions; and 1961 when, in the spring and early summer, the population rapidly declined. As a result of our studies we know much more about the Lemming's habits than before, but very much work is still required before detailed answers can be given to the above questions.

Like many other rodents, the Lemming eats fresh sedge and grass. Another source of nutrition is mosses on which few other animal species feed. In the winter, after most of the sedge and grass has withered, mosses are the Lemming's principal food. After the snow has melted in the spring and even in the summer it is therefore easy to see from ravaged moss patches where Lemmings lived during the previous winter. In the springs of 1959 and 1960 some such places were found in birch forests but the bulk of the Lemmings had wintered beyond the tree-line. The wintering sites we found in these years, however, were small in area and limited to non-marshy spots where the snow cover had been particularly deep.

After the snow had melted we tried hard to find Lemmings from these wintering sites, but in vain. There were two possibilities: either the



Many Lemmings spend the winter in this kind of rugged environment. Right — The winter nest of the animal is about to appear from under a snow bank.

Photos by P. Korhonen

Lemmings had died or they had moved elsewhere. The latter proved to be correct, although it was a fairly long time before the matter was clarified. This was not because places suitable for Lemmings were few in summer but because they differed so radically from winter sites that the idea of looking for Lemmings in them never occurred to anyone. It emerged that in the summer of 1959 practically the entire Lemming population lived on peatlands, and that in the summer of 1960 peatlands were again the preferred habitat.

Peatlands grow plenty of mosses suitable for the Lemming's diet, but it is primarily the plentiful sedge food that attracts them to peatlands for the summer. The most remarkable difference from their winter habitat is the wetness of peatlands. It is this very wetness which makes peatlands unsuitable for winter quarters: ice denies the Lemming moss coverage, and the sedges and grasses wither. The Lemmings are already beginning to leave the peatlands in late summer, just as many migratory birds leave their nesting areas long before the waters freeze and the ground is covered with snow. The Lemming migrations we studied were, therefore, connected with the seasonal change of habitat.

Although we are still far from understanding all the different patterns of behavior among migrant Lemmings, we do at least now understand some of them better. If the significance of migra-

tions were only to check the size of the population, the fate of the migrants would be an issue of only secondary importance. In actual fact, however, migrations are of vital importance in the life of an individual Lemming. It is therefore understandable that wanderers have developed special means of protection against enemies and that they do not heedlessly rush into danger but are able to adapt their behavior to different emergencies.

Lemming movements differ in one remarkable point from the seasonal migrations of some other mountain animals. Peatlands, where the majority of Lemmings were to be found in the summer, cover extensive areas only in the forested zone and in the lower reaches of the alpine zone. Most of the winter sites we found were at greater heights of the alpine zone. For their seasonal change of habitat, therefore, the Lemming population had had to move down in the spring and up in the autumn, which is of course directly contrary to birds, for example, which in mountain districts migrate seasonally.

A closer study of this matter took first priority in the 1961 program, which was financed mainly by the New York Zoological Society. Although the material is as yet still to be analyzed, some of the main features nevertheless seem clear and I am pleased to have this opportunity of reporting on them.



In 1961, studies were carried out at greater altitudes in the fjells than before. Above a height of some 2,500-3,000 feet, remarkable changes occur in the plant cover of the alpine zone. The undergrowth vegetation of dwarf birch, *Empetrum*, etc., that flourished at lower heights, comes increasingly to be replaced by sedges and grasses. Moss carpets become more and more continuous. We already knew that these moss carpets, which also grew sedge and grass that remained green under the snow, were just the sites which the Lemmings preferred for wintering, and they were much more frequent at this altitude than lower down. On the northern and eastern slopes of high fjells, where the snow cover stays until or even after midsummer, moss carpets are increasingly extensive.

A deep snow cover of long duration creates the conditions for the development of the vegetation required by the Lemming for its wintering site. This is why the majority of Lemmings winter high in the fjells. On the other hand, the peatlands which survive in the severe climate of the fjells are exceedingly small. For this reason these regions are unfavorable for the Lemming's summer habitat, so it moves down in the spring, especially when the population is considerable.

Some surprising details emerged high in the mountains.

In spots where the snow persists longest, let us

say up to the latter half of July, the plant cover becomes less continuous. Of flowering plants, only the beautiful pink-blossomed *Ranunculus glacialis*, of the buttercup family, thrives. Mosses and lichens form patches between stones and gravel. The Snow Bunting spends part of the summer in such places, but at first sight it seems impossible that any vertebrate species could live through the winter in this inhospitable region. Nevertheless, the moss cover here, too, had been cropped by the Lemmings; the globular winter nests of the species were found between blocks of stone, and its runways went under the snow.

According to a hypothesis put forward many years ago, the Lemming survived the glacial period in northern Europe on the small ice-free areas that existed here and there, *e.g.* on the Norwegian coast. I will not discuss that hypothesis here. It is obvious, however, that the Lemming has adapted itself to a life in utter extremes. The 1961 studies showed that the Lemming favors as winter food expressly those low-growing moss species which are typical of areas where the snow stays longest. Another of its adaptations to a life close to snow is that it breeds not only in summer but also in winter, under the snow. This was a discovery so far as the Norway Lemming was concerned, even though it was previously known to be true of the Brown Lemming living in the arctic regions of North America.

7 Olms, a Longevity Record, Babies... A New Year's Chronicle

By **WILLIAM BRIDGES**
Curator of Publications

THE CABLEGRAM arrived on November 17 and was clear enough, but puzzling. It was addressed to "Mister James Oliver" and it said: "Proteus arrive Wednesday the 22nd or Thursday the 23rd of November care to take them at once letter following" and it was signed "Aquarium Maribor Rechberger."

Obviously we were being given some specimens of *Proteus anguinus*, the Olm or European Blind Salamander. But why? It was, presumably, a shipment that had been arranged by Dr. James A. Oliver while he was Curator of Reptiles (he became Director of the American Museum of Natural History in 1959), but if so, it had taken a long time to consummate.

Just how long we did not realize until a search

of the Reptile Department's files turned up a sheaf of correspondence from the fall of 1953. William Rechberger, Director of the Aquarium at Maribor in Yugoslavia, had written to Dr. Oliver proposing to send us several Olms in exchange for young Alligators and Caimans. We had promptly shipped the crocodilians, but the promised Olms had not followed quite as promptly. Now, something more than eight years later, they were on their way.

The letter referred to in the cablegram was

The white, blind Olm — equipped with four functional legs and external gills — seldom shows such activity as this. As long as the water is well aerated, it lies on the bottom.



apologetic. Neatly typed, and in English that showed a considerable improvement over his command of the language in 1953, Mr. Rechberger wrote:

"There were many difficulties concerning the export of these animals. It took a long time before J got the export license for them. As you certainly know these animals are national preserved and are already rare with us. We have sent some to Germany for the price of 20 dollars per specimen.

"All these specimens have been caught recently in the open country, but not in the world known grotto at Postojna (Adelsberg). The biggest specimen, a pregnant female is a very interesting one, since it is grey. In all probability this animal was frequently coming in contact with the daylight for in other way J cannot declare its tinge. There would be no little sensation if you succeeded in breeding them."

Mr. Rechberger advised keeping the Olms under red light, at a temperature of about 60 degrees, and feeding them twice a week.

In view of what we already knew about the Olm, his letter makes a number of interesting points. The animal has been known to science for well over 200 years and its only habitat is in the mountainous regions at the upper end of the Balkan peninsula. White, blind, about eight inches long, the Olm inhabits the many caves in the area, particularly the big cave at Adelsberg, and a hundred year ago exhibiting the caves and their Olms to tourists was a thriving business. Periodically, especially after the spring thaws when subterranean waters rose high, Olms were washed out of the caves into open streams, and peasants used to collect them, put them into glass jars half filled with water, and sell them to tourists. Now, it seems, they are not as plentiful as they used to be and are protected by the government. Ours, Mr. Rechberger said, were caught in the "open country," and therefore must have been washed out of the caves.

As for the specimen that Mr. Rechberger called a pregnant female, we have not had enough experience with Olms (we have exhibited them once before, in 1957) to confirm his diagnosis, nor have eggs or young been produced. Recent experimental work indicates that the Olm is normally oviparous; that is, eggs are produced inside



Our Tuatara has been in the collection 6 years and shows no sign of its age (its kind is believed to be about 100 million years old!). Unlike other reptiles, it must be kept cool.

the female's body and are then deposited in the water, where they hatch. Previously it had been thought that the young were formed inside the body and were born alive, but the work of A. Vandel and M. Bouillon (published in France in 1959) appears to contradict this. There is at least one old report that a baby Olm hatched from eggs in the water — 90 days after they were deposited. Even today, after a lapse of two centuries, many things remain to be learned about the Olm and Mr. Rechberger is undoubtedly right in saying that there would be "no little sensation" if we succeeded in breeding them. We are keeping a close watch on them.

However, our first problem is to induce them to eat, and nothing offered so far—tubifex worms, minced horseheart, bits of clams — has been accepted. Olms are notorious for going a long time — even a year — without feeding so we are not yet discouraged.

All seven of them are being exhibited under red fluorescent light in the entrance hall of the



Four feet 7½ inches of gentle dynamite! This Caiman is the only “pet” specimen we have ever had; its tameness resulted from its being played with and hand-fed ever since it was about eight inches long.

Reptile House. Some small amount of daylight does enter their tanks, when the entrance door is opened by visitors, and it seems to us that they are becoming slightly darker. A sheet of red cellophane to exclude this casual daylight may keep them from turning any darker. We keep them in a 65-75-degree temperature range.

One of the Olms' neighbors in the hallway of the Reptile House drew special attention to itself in January — not, like the Olms, for being a new arrival, but for the opposite reason of having been in the collection for six years. This is the Tuatara, a rhynchocephalian from New Zealand, which came to us on January 21, 1956, and has established a longevity record in this country. It still has a long way to go before it equals the record of 33 years set by a Tuatara in the Dublin Zoo, however.

For some weeks during the fall and early winter visitors to the Reptile House were treated to an unusual show when Head Keeper Spencook took time out to play with a 4-foot 7-inch Caiman.

Caimans are notoriously untrustworthy and dangerous, but this one came to us with quite a different history.

Its donor was Mrs. Frances Hennequin of Great Neck. It was, she said, presented to her by a friend who had bought it as a “souvenir” in Florida in 1951 or 1952. (Baby Alligators are protected by law in Florida, and consequently South American Caimans are usually sold in tourist shops). The baby was only about 8 inches long when it arrived, and was “inclined to be nippy at first,” snapping to the right and left each time a hand approached it.

Eventually it calmed down and adopted a warm spot on the tiled kitchen floor as its daytime home. At night Mrs. Hennequin kept it in a bathtub, and it was in the tub that she fed the little reptile, for at first it refused to eat on the kitchen floor.

Sometime later a cat joined the Hennequin family and to Mrs. Hennequin's surprise it and the Caiman took a liking to each other. She says

that they slept together, the cat's head resting on the Caiman's back. The Caiman learned to eat in the kitchen at the same time as the cat, and many times the cat presumed on friendship enough to reach into the Caiman's mouth and pull out a piece of fish it coveted. "I used to shut my eyes," Mrs. Hennequin said. "I was sure Ovie was going to bite the cat's paw off, but he never did."

(The Caiman was named "Ovie," for the friend who had given it to Mrs. Hennequin.)

In summer, Ovie had his own plastic swimming pool in the back yard, with a ramp so he could get in and out at will. He used to wander around the yard, always with the cat in attendance. In the evening, he often came into the living room and stood looking up at Mrs. Hennequin until she took him on her lap while she watched television.

Finally, when Ovie had reached a length of more than 4½ feet, he no longer fitted comfortably in the bathtub, and with winter coming on Mrs. Hennequin regretfully decided to give him to the Zoo. The cat mourned for three days, refused to eat, cried, and wandered around the house looking in all the places where Ovie used to hide, she said.

Ovie was still gentle enough to allow Head Keeper Spencook to pick him up and stroke him for several weeks after he came to the Zoo. Recently, however, for reasons of exhibition space, he has been put in one of the side pools in the Reptile House with a number of other Caimans,

and it is difficult to extricate him for petting. He will, we think, soon revert to his wild ways and no longer submit to handling.

THE END of an old year or the beginning of a new one is a convenient time to look around the Zoo and comment briefly on some animals that — if not exactly overlooked — deserve a little more attention than they got.

Such are the young Hamadryas Baboon and the little Japanese Macaque that are living and playing together so happily in the Monkey House. Both are victims of — well, "unfortunate home life" comes as close as anything.

The young Hamadryas was born in the collection last June and his father immediately tried to "adopt" him, seizing him and carrying him at every opportunity. Since the baby was still dependent on its mother, the father was excluded from the compartment, but when he was finally allowed back his possessiveness was unabated. He apparently considered the baby a living rag doll, for he delighted in grabbing him and tossing him into the air — sometimes bothering to catch him and sometimes just letting him plop to the floor. We could foresee a badly damaged baby if that kind of rough play continued, and so we removed him. It was an easy decision to make for at that time there was another baby in need of a room of his own.

That was a little Japanese Macaque that had been born en route to the Zoo from Japan last spring. He was, to human eyes, a most engaging

A little Hamadryas Baboon (left) and the young Barbary Ape were quartered together in the Monkey House more or less by chance, but now they are friends and inseparable.





For the comfort of the animals — and for our own convenience, since space is at a premium — we tried to give this young Callimico a marmoset companion. He fights “intruders.”

and thoroughly well integrated baby, but after he had a fall and was taken to the Animal Hospital for treatment, he was not welcomed by his family on his return. He needed companionship, and the young Hamadryas needed the same thing. Now they are practically inseparable and if they have to be parted for even a short time,

both scream their anguish. Like the spoiled babies they are, they get their way.

The Monkey House has another problem of just the opposite kind — a Callimico that doesn't want a companion and, indeed, refuses to have one. Space being limited, and the Callimico being quite a small marmoset, we thought it would be nice for both the Mammal Department and the Callimico if two or three marmosets could share the compartment. The Callimico thought differently, and since she is a rare and delicate creature we are letting her have her way. She occupies one big compartment all by herself. She has, incidentally, been in the collection since September 1, 1959, and has not yet begun to show the white rings around the tail that are characteristic of an adult.

The way 1962 is starting, this is going to be a good year for babies around the Zoo. The Kangaroo House is also making a contribution. Three Dingo pups were born on December 26 (to a pair themselves born in the Zoo last year) and are already fat, well-haired and thriving. So far they have done little except sleep, nurse and sleep again, but in the next two or three weeks they will be at a playful puppy stage. Two of last winter's pups, which were fondled and played with in order to keep them tractable, are still as affectionate with their keeper as they were when they were puppies. However, the mother and father of the new babies were never petted and Keeper Charles Foster of the Kangaroo House says he does not entirely trust them. “They look at you with those sad eyes, like a collie's, and then they snap,” he says.

We know there is a “joey” in the pouch of one of the Agile Wallabies in the Kangaroo House, but it has not yet been seen. It was born late in the fall and it will be some weeks yet before the baby puts its head out for the first time. Gradually we are building up a nice “mob” of wallabies; we have five Agiles, all born here, plus the baby in the pouch. All are extremely skittish, however, except “Matilda,” the Agile Wallaby whose mother rejected it and which Curator Davis of the Mammal Department reared by hand, in a knitted substitute pouch. While the other Agile Wallabies leap and scramble at any sudden motion by a visitor, Matilda still comes to the front of the compartment to have her nose scratched.

CONSERVATION

FOUNDATION



Samuel H. Ordway, Jr.

On January 1 the Trustees of the Conservation Foundation announced that Fairfield Osborn, having resigned as President, had become Chairman of the Board, and that Mr. Samuel H. Ordway, Jr., had been elected President.

These are somewhat cold words, scarcely suggesting the happy partnership which has existed between Dr. Osborn and the staffs of the Foundation and the Zoological Society for the past fourteen years, nor the challenge which faces the Foundation today. To truly evaluate the significance of the change, one must add a few words about our new President.

William Cowper once wrote "The pipe, with solemn interposing puff, makes half a sentence at a time enough . . ." Be not deceived; the pipe once removed leads to words, words lead to sentences and sentences to books of the quality of "Resources and the American Dream" and "Prosperity Beyond Tomorrow." This is a man able to see, as Walt Whitman himself saw long before industrial and urban life had reached their present intensity, that "without wilderness Democracy will fail."

Today when the conservation world itself is in

a state of transition and when its interests are broadened by such vital problems as population explosion and the desperate need for a Conservation Ethic, the time demands a personality which expresses and dramatizes the need for study of the new problems. "It may be," says our new President, "that in the present state of evolution of human society, the conservation movement should take on new form with new approaches to public comprehension basic to action."

The urgency felt fourteen years ago when four men, under the leadership of Fairfield Osborn, sat down to create a Foundation, with Samuel Ordway as Executive Vice-president, is even more urgent now.

The lamp is lit; the pipe is burning; the issue is there; the new President is ready to tackle it.

Briefly Noted

President Samuel Ordway accepted the invitation of Secretary of Agriculture Orville Freeman to participate in a conference on "Land and People" at the Department of Agriculture in Washington on Jan. 15. The meeting was directed toward shaping new land and water policies in order that the needs of those living on the land and using land and water will be better served . . . George E. Brewer was one of three principal speakers at the National Methodist Conservation Consultation in Washington from Jan. 31 to Feb. 1-2 . . . Books and publications scheduled for early 1962 distribution include: Frank Fraser Darling's "Education of African Natives"; Richard Cooley's report for the Foundation, "Rise and Fall of the Alaska Salmon"; Hugh A. Johnson and Dr. Harold T. Jorgenson's book "The Land Resources of Alaska," published by University Publishers for the University of Alaska; and the Conservation Foundation's own volume "Implications of Population Pressures," published by Doubleday & Co.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Dr. Tee-Van Receives Gold Medal of the Zoological Society

Dr. John Tee-Van, General Director of the Zoological Park and the Aquarium, was given the Gold Medal of the Zoological Society on the evening of December 19, at the annual dinner meeting of the Society's trustees. It commemorated fifty years (as of August 23, 1961) in the service of the Society — a distinction possessed only by Dr. William Beebe and Dr. Tee-Van, although Lee S. Crandall, General Curator Emeritus, is a close third, having been with the Society for forty-four years at the time of his retirement; he was still working for the Society in the writing of a book when he achieved his fiftieth year four years ago.

In responding to the presentation, which was made by Dr. Fairfield Osborn, Dr. Tee-Van outlined his career with the Zoological Society since he became an assistant keeper in the Bird Department in 1911 at the age of fourteen — a career which embraced a long period with the Department of Tropical Research.

"You may ask what I am going to do after reaching my sixty-fifth birthday and completing fifty years with the Society," he said. "It is very simple. I am going back to work with my old favorites, the fishes, and — what is more to the point — in the laboratory of the Department of Tropical Research at the Zoological Park.

"I want to give my blessing to the millions of animals that I have known, to the untold insects of South America and other countries that I have captured, to the hordes of animals that were caught by our nets in the sea — the copepods, shrimps and coelenterates, the untold number of fishes, both deep-sea and shallow-water that I have seen, ranging from tiny creatures within their eggs to the 42-foot Whale Shark that we harpooned off Cape San Lucas, to the birds and reptiles that I took care of here in the Park, and finally to the mammals and to the two Giant

Pandas that I brought here from China. If I had to do fifty years over again, I could not ask for a more magnificent organization to work for than the New York Zoological Society."

African Students Tour Park and Act in Film

A report has just been received by the Zoological Society from Tanganyika about a holiday week-end in October spent in the Lake Manyara National Park by three African boys who have shown particular interest in their country's conservation problems.

The boys — Onesmo Moiyo of Il Boru, Anton Lawrence of Umbwe and Ismail Elisali of Old Moshi — were conducted through the Tanganyika park by William Eddy, a teacher and naturalist who is making a conservation film in Tanganyika under the sponsorship of the Zoological Society.

On their return to their schools, the boys wrote essays about their experiences, and their conclusions indicated that the excursion had made a great impression on them. Onesmo Moiyo wrote:

"I believe that the best way to elicit cooperation from the people of Tanganyika, some of whom are now indignant with the National Park authorities, would be to make them understand the importance of preserving the game. It is that sense of responsibility and understanding that our National Park authorities have to appeal to for co-operation from the public."

Anton Lawrence wrote: "One feels out there in the Park that one could be content to watch for ever and to enjoy these marvels of nature . . . I still sometimes feel that I am watching and listening and learning about the wonders which are so near and so little appreciated by so many people."

Ismail Elisali was most explicit: "The fascination obtained by observing game and vegetation of the Park means only one thing. Wildlife should be preserved at all costs. In fact, it is the cheapest way of raising our national income through tourists — instead of investing capital to exploit our national resources. After all, only Tanganyika possesses this wonderful gift, so this should be our national pride."

The three boys appear in the film made by Mr. Eddy, and their experience of being "actors" and

seeing the wonders of their own national park have made them greatly envied in their communities, Mr. Eddy wrote. His film is being given a sound track in Swahili and English, and will be shown widely in Tanganyika.

Long-lived Bushmaster Dies Short of the Record

After 17 months and 2 days in the collection, our long-lived Bushmaster (*Lachesis muta*) suddenly died of unknown causes on December 23. The overloaded window air conditioner that had kept its compartment cooled to 65 degrees F. during all those months (see *Animal Kingdom*, Sept.-Oct., 1961) had broken down some weeks before and we had to move the snake to temporary quarters behind the scenes. Although we do not yet know the cause of death, Keeper Robert Brandner (whose special charge it was) and all of us who had worked with it are confident that it would still be alive if we had been able to maintain it in its regular quarters.

During its stay with us the Bushmaster had fed voluntarily 15 times on mice, rats and hamsters. It had shed its skin in normal fashion eight times. Although it had already broken all records of longevity in any one zoological park, we had also hoped to break the 20-month record of Prof. Ulrich of Trinidad and the old Reptile House in 1935.

Approval has been given to the provision of adequate air conditioning for two sections of the Reptile House. As soon as this is installed, we will again seek to put on display the "only contented Bushmaster in any Zoo."—H. G. DOWLING

A Practical Step in Conservation of a Rare Pheasant

Some weeks ago it developed that we had in our collection one of the few female Mikado Pheasants in the United States — and that Lloyd Minicks, an amateur aviculturist of Knoxville, Tenn., possessed a male of the species. Since the Mikado, native to Japan, has dwindled in numbers both in captivity and the wild, we have made an arrangement with Mr. Minick whereby our female has been loaned to him for an indefinite period. If breeding occurs, we are to receive a pair from Mr. Minicks.

Bahamas National Trust Meeting

Dr. Carleton Ray, Associate Curator of the Aquarium and secretary to the Bahamas National Trust, attended the third annual meeting of the Trust at Nassau late in November. Two major advances in Trust activities were reported. There has been spectacular success in breeding at the flamingo colony at Inagua, where 20,000 birds produced more than 8,000 young; the colony now includes about two-thirds of the entire flamingo population in the Caribbean, and is under the care of the Bahamas National Trust. It was also reported that the Bahamas Legislature has amended the act of 1959 so as to establish the Trust on a permanent basis.

IN BRIEF

Our First Baby Chevrotain. By no means the first baby of the new year, but certainly one of the most interesting and engaging, is the Chevrotain, or Small Malayan Mouse Deer (*Tragulus javanicus*) born in the Small Mammal House on January 8. It is a perfect miniature replica of its diminutive parents — which is to say that it is very small indeed. It stands about five inches high — when it stands. Much of the time it prefers to lie, legs doubled up under its black-and-tan body, in a narrow space behind a tree root in the compartment.

BIRD WATCHERS' SAFARI Kenya — Uganda — Tanganyika June 9-July 17, 1962

A safari for Members of the Zoological Society who wish to see the spectacular bird and mammal life of East Africa at reasonable cost is being sponsored by the Society. It will be under the leadership of John Williams, Ornithologist of the Coryndon Museum at Nairobi, and will be conducted by Ker & Downey Safaris, Ltd., long experienced in photographic expeditions. The group is limited to 16 persons. Interested Members are urged to make prompt application to the Zoological Society's offices for details and reservations.

PUBLICATIONS OF INTEREST

THE ENCYCLOPEDIA OF THE BIOLOGICAL SCIENCES. Ed. by Peter Gray. xxi + 1119 pp., 84 photos, 400 figs. Reinhold Pub. Corp., N. Y., 1961. \$20.00.

Obviously, no single volume could encompass, however briefly, all the subjects included in Biology, but this one-volume encyclopedia presents a reasonable, well-balanced selection of topics that makes readily available a sizeable segment of basic, up-to-date biological information. Among its 500-odd contributors are some of the most prominent biologists of today. The book has been designed, successfully, to meet the needs of the wide-

ranging professional, the enterprising teacher and the enquiring amateur. — J. W. Arz.

A NATURALIST IN ALASKA. By Adolph Murie. Drawings by Olaus J. Murie; photographs by the author and Charles J. Ott. 302 pp. Devin-Adair Co., New York, 1961. \$6.50.

Adolph Murie is one of the great naturalists of the present day. In a Foreword, his brother Olaus says of his research methods: "It means living with the animals, trying to think as they do, establishing an intimate relationship . . . that reveals their motivation in all they do." The Muries learned about Alaskan animals the hard way, in the days before the airplane, and this book is full of pungent first-hand observations of the Lynx, Bears, Moose, Wolverines, Dall Sheep, Caribou and many other animals. It can be strongly recommended.

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Arts of Nature and Arts of Man (*continued*)

eventually permit this planet, our earth home, to become *man's alone* — devoid of the miracle of other living things? This would be the road to ultimate sterility. Then, indeed, we shall have "had it."

Our Zoological Society is embarking on a great enterprise in our Fund Campaign. We *must* make it successful, because imaginative and indeed superb things can be done for the two great public institutions under our management as well as for the advancement of our other purposes. We begrudge nothing to our sister institutions that have in their care the Arts of Man — may they continue to flourish. However, we look for equivalent support for our own institution, the preeminent one of its kind in this country, which has in its care these dynamic creatures expressive of the Arts of Nature.

A final remark — *not* made invidiously. The future programs envisioned for the Zoological Park and Aquarium can be accomplished if we receive contributions equal to the price of a couple of works of art — *man's* art — recently publicized in the press. One almost wonders — are we being too modest in our goal? Let's at least be sure we reach *it* — and then, as time runs on, go on from there.

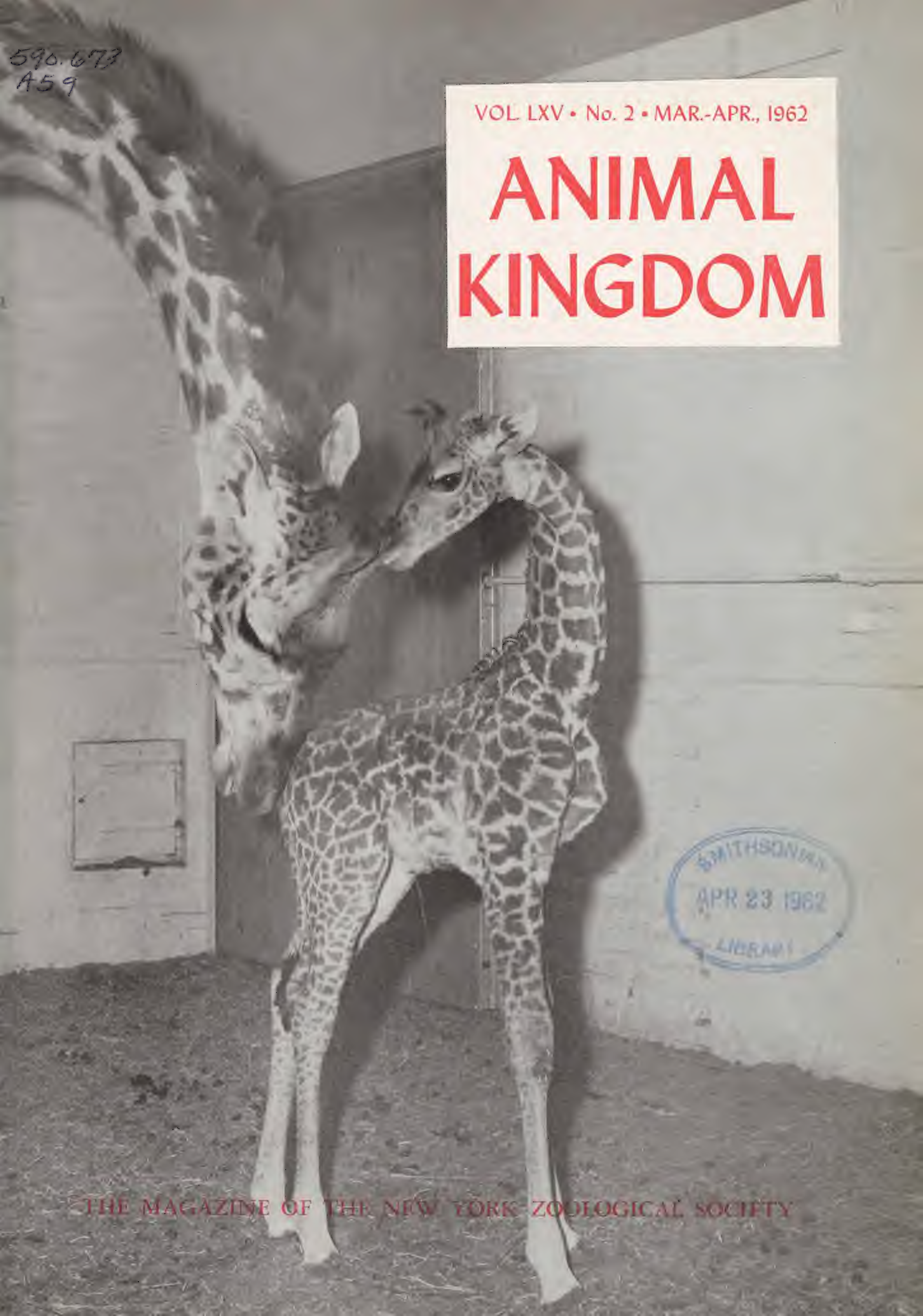
Postscript

It is interesting to note that Mahatma Ghandi, the Indian philosopher and political leader, once expressed similar thoughts. In "The Meaning of Wilderness to Science" Dr. Ian McTaggart Cowan of the University of British Columbia quotes the Mahatma:

"I love music and all other art, but I do not attach such value to them as is generally done. I cannot, for example, recognize the values of those arts which require great technical knowledge for their understanding. When I gaze at the star-strewn heavens and at the infinite beauty which confronts my eyes, they mean more to me than all human art can give me. That does not mean that I ignore the other values, but personally, in comparison with the infinite beauty of nature, I feel their unreality too intensely. Life is greater than all art."

Fairfield Osborn





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AFFILIATE

Richard A. Cooley, *Director*
Alaska Research Station, Juneau

ANIMAL KINGDOM

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Thanks to a Hummingbird

OCCASIONALLY AN INCIDENT releases the mind or the imagination — they are much the same — to new dimensions of consciousness.

The incident itself had no special significance at the moment except wonderment that nature could produce a bird so small and exquisite, and that, in turn, its kind could have found a way of survival through countless generations. The bird was a hummingbird, known as the Racquet-tail (*Ocreatus underwoodii peruanus*) that had recently come to our collections from Ecuador. This avian gem is barely half the size of its North American relative, the familiar Ruby-throated Hummingbird, which itself weighs no more than a penny. Not so far away in the Zoo were Eagles and Condors and “giants” of birds such as Cassowaries and Ostriches, and “in between,” so to speak, some half a thousand other species of various forms, color and modes of life.

There was a time on this earth when there was no living creature moving upon its surface — the nascent period that witnessed the arrival of primitive plants and animals. It is difficult to comprehend the vastness of a universe containing more than a million galaxies as large or larger than our own solar system. It is equally difficult to envisage the eons of life-creative processes on this planet, which, in the case of birds, have resulted in more than eight thousand different species, including Eagles soaring towards the empyrean, and hummingbirds darting through the cloistered forests of the tropics. Yet the creation of birdlife is only a part of the story of evolutionary processes.

There is nothing new in these thoughts. Many of us, from time to time, indulge in moments of speculation concerning the universe and life upon this earth. Yet, the tiny Racquet-tail Hummingbird somehow brought these wonders into sharper focus — and consequently this word of gratitude.

Fairfield Osborn

SMITHSONIAN
INSTITUTION

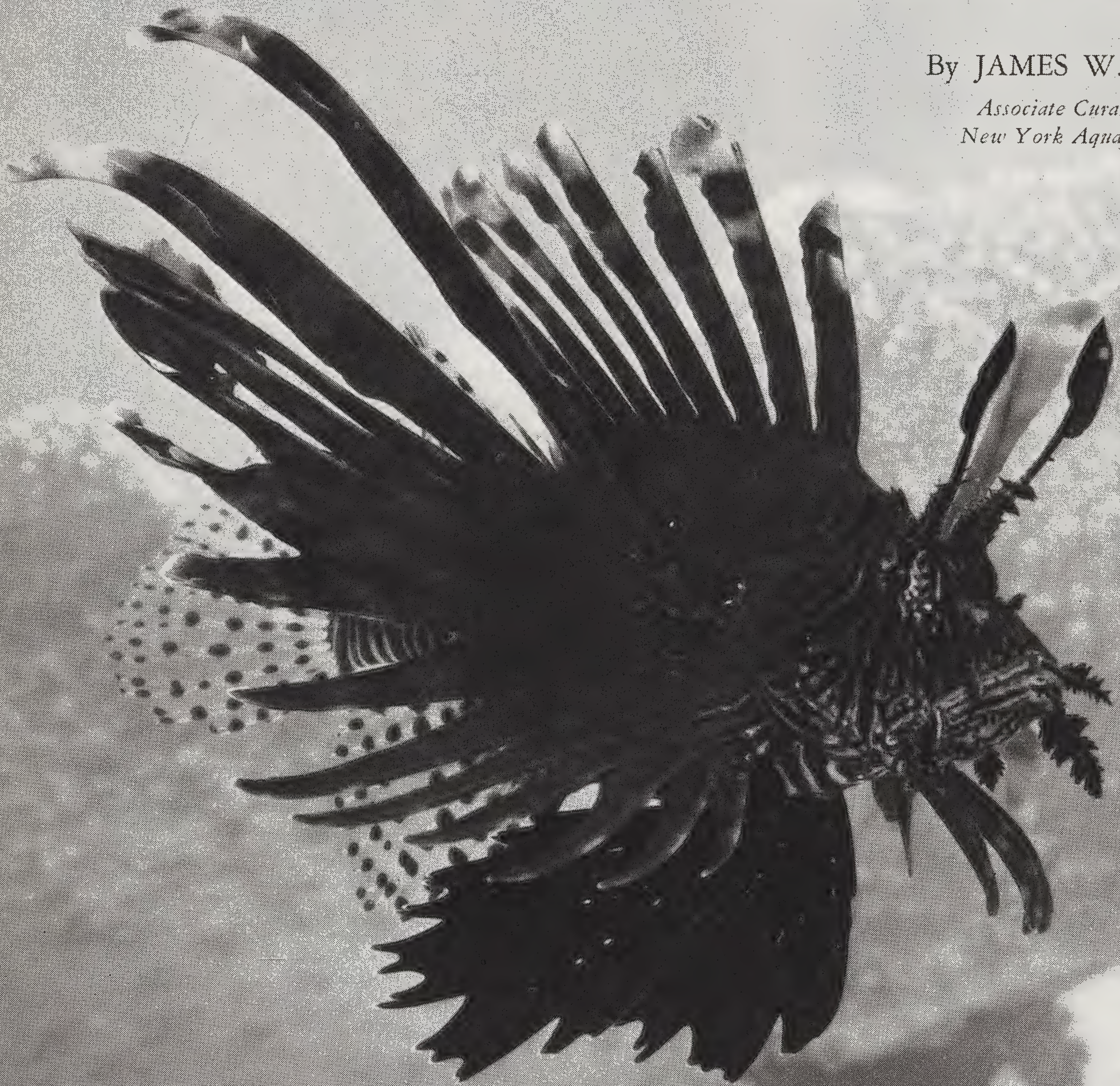
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A Show-stopper—

The Flamboyant Zebra Fish

By JAMES W. ATZ

*Associate Curator,
New York Aquarium*



WHEN THE NEW YORK AQUARIUM received its first Zebra Fish in 1931, it created a sensation — probably a greater sensation than any other fish of its size ever had before, or will again. This may seem too dogmatic a declaration, now that Zebra Fish have become commonplace in public aquariums — and especially in the light of all the wondrous creatures that must lurk still undiscovered in the sea. But I am confident that I am not exaggerating, for I have observed the reactions of aquarium visitors a good many years, and for inducing sheer amazement there is no fish (except the giant ones) like the Zebra Fish. Some ordinary-sized species may make a greater ultimate impression or evoke deeper esthetic feelings, but for an electrifying, show-stopping effect, there is hardly anything in an aquarium to equal a Zebra Fish on display.

Moreover, the fish is on display most of the time, out in the middle of its tank with all its finery exposed. And what finery! In fact, the fish is so well decorated that on first seeing it, the thought that immediately comes to mind is: Can this really be a fish? All the fishy attributes are there — head, body, tail and fins — but so flamboyantly represented that the ensemble seems unreal. The head and body are finely striped, dark maroon or gray on a silvery cream background,

and the same general effect is achieved on the fins by several series of dark spots. The head is adorned with a dozen or more intricately colored and shaped tabs of skin, the largest over each eye like some weird kind of eyebrow. The fish's ventral and anal fins are well developed but not particularly unusual in shape. Its dorsal, on the other hand, is highly unusual, with each of its 13 spines separated from the others except near the base, the first ten or eleven of them being extra-long, each one edged along its entire posterior margin by a thin flap of skin. Most striking of all are the pectoral fins which are enormous and also consist of separate rays, about 15 of them, each with a well developed filmy border. When a Zebra Fish moves slowly and majestically through the water, all its fins expanded and with flaps waving like pennants in a gentle breeze, it frequently makes you think of a stately ship under full sail with all flags flying.

To see one of these fish floating idly in the sea with all fins and filaments extended is one of the most gorgeous sights in nature, according to South Africa's leading ichthyologist, Dr. J. L. B. Smith. The Zebra Fish is not at all adverse to showing itself in its natural habitat. Evidently its display behavior in captivity is carried over directly from the wild. Moreover, when approached by man under natural conditions, the Zebra Fish seldom turns tail and flees — as the great majority of fish would do — but stands its ground, apparently well aware of the oversized intruder but unafraid of him. As a matter of fact, the principal reason why Zebra Fish are often in good supply among the dealers in salt water fish is that they are relatively easy to net. But such brazen behavior in a fish that seldom exceeds a foot in length should be suicidal for a variety of reasons — most of them big, hungry fish. The reason it isn't is that the Zebra Fish has a powerful weapon to defend itself. Like the skunk or porcupine, the Zebra Fish possesses an almost invulnerable defense, and like these small mammals you frequently find it out in the open, acting as if it had a defiant disposition. And, we should add, like the skunk

No matter from what angle you view a Zebra Fish, its large fins with separate rays and its boldly striped coloration require a second look to make certain that what you are seeing is really a fish.



it has a bold color pattern that makes it stand out even more.

Eighteen weapons, not one, more accurately describes the Zebra Fish's armament, for this is the number of venomous spines that it carries — 13 in the dorsal fin along its back, three in the anal fin on its belly, and one in each of its paired ventral fins. Although the fish's pectoral fins are its largest and the ones mostly responsible for its spectacular appearance, they are harmless. Except at the needle-sharp point, each venomous spine is basically T-shaped in cross-section, consisting of a bony central shaft with a well developed flange that runs along each side at the rear. This skeleton is covered with flesh and skin so that the whole spine is more or less triangular in cross-section. The tissue that fills in the angle between the central shaft and the lateral flanges is glandular to a considerable extent, and this is where the venom is produced.

Experts who have studied the venom apparatus of the Zebra Fish say that it is one of the most highly developed of any found in fishes, although it cannot compare in efficiency with the hypodermic-like arrangement of the vipers. Even though the venom glands themselves enter the wound as the fin-spine penetrates the flesh of the victim, and come into actual contact with it since the delicate skin and overlying tissues of the fin are themselves torn and peeled back during the penetration, only a small amount of venom is introduced into the wound. The extreme toxicity of the fish's venom helps compensate for this, but the final result is that a Zebra Fish sting is usually not as dangerous as a snake bite.

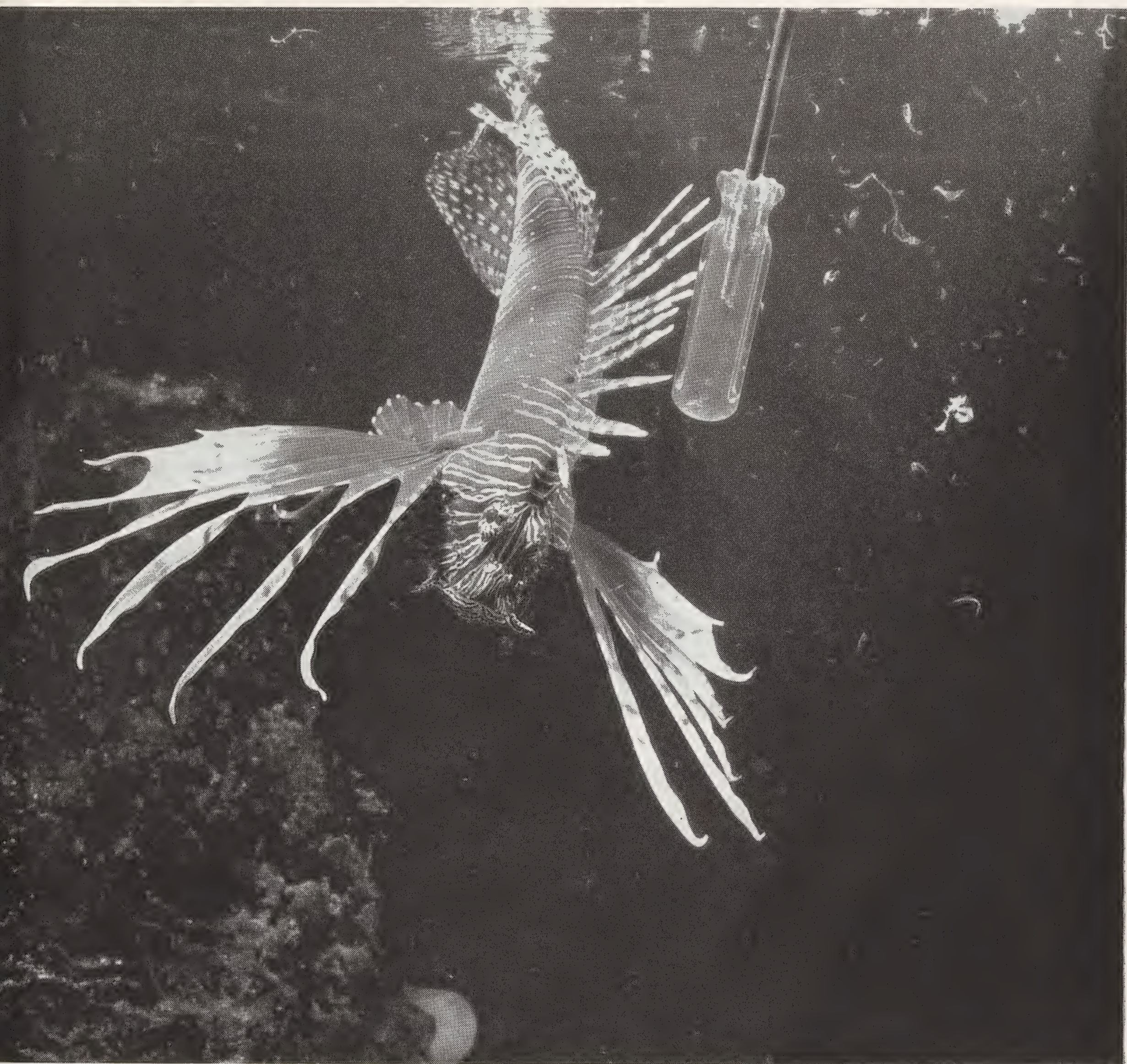
Nevertheless, the sting from even a single spine of a Zebra Fish is something to reckon with. Stings from two or three at once — always a possibility because of the proximity of the fin-spines — are just that much more serious. There does not appear to be a record of any authenticated death caused by a Zebra Fish. Dr. Smith heard of several in South Africa, but was unable to confirm any of the incidents. While collecting in Samoa, Dr. Leonard P. Schultz of the U. S. National Museum heard about a boy who reached under a shelf of a coral reef, was badly stung by a Zebra Fish and died in agony a few days later, but again no documentation was forthcoming. That these incidents could really have happened is borne out

by the recent first-hand medical report on a healthy man who was stung by two spines and whose death appeared imminent from a type of heart failure that was very similar to the condition induced in laboratory animals by injecting Zebra Fish venom. Whether or not the affected part swells and whether or not there are after-effects apparently depend on the amount of venom received, but the pain is excruciating whether it lasts three hours or a day. How it feels to be stung by a Zebra Fish has been graphically described by Prof. H. Steinitz of the Hebrew University of Jerusalem. He had been testing the reactions of a Zebra Fish in the Gulf of Aqaba when his right forefinger was penetrated by two spines. Subsequent events showed that this was not a serious sting, and the pain was negligible after three hours. But what a time Dr. Steinitz had during those 180 minutes! "About half an hour after the sting had occurred, pains were almost unbearable. . . . I was not aware of any general symptom. My pulse was entirely normal, no headache or nausea. Under these circumstances, I was certain that the process was strictly limited, but the local condition appeared nonetheless unbearable. I was tortured by pains beyond measure, and yet the pain was still growing more intense. It sent me running. I tried to sit down, to lie on the ground, to stand still. The pain would not let me. I had to move on, to run about.

Not all captive Zebra Fish are aggressive enough to attack an object put into the tank, as this one is doing. Head down, it is directing its venomous dorsal spines accurately at a screwdriver handle.

It is a strange experience, recognizing quite lucidly that nothing fatal has happened to oneself, and feeling at the same time, that this was much worse than anything previous. In fact, it is just short of driving oneself completely mad." One of the Aquarium's Tankmen, Edward Dols, was stung by one of our Zebra Fish on December 12, 1957, and when I recently showed him Steinitz's vivid account, he agreed that it was indeed a good description of what it was like. Dols' case was more serious than Steinitz's: three spines entered his thumb, he was in serious pain for a whole day, and some pain persisted for almost a week.

It is sometimes possible, however, to brush



against the spines of a Zebra Fish with impunity or to receive no more than a slight burning sensation that lasts about ten minutes. It was the knowledge of several such incidents that led me, in June, 1957, to declare that the Zebra Fish "was once believed to be venomous, but this seems not to be the case." How I have regretted that *lapsus calami*!

So potent is the venom of the Zebra Fish that pharmacologists and biologists are studying it in order to learn just how it works, as well as find out the best way to treat the sting. Any substance that exerts such profound effects, even when diluted tremendously, could well become a most

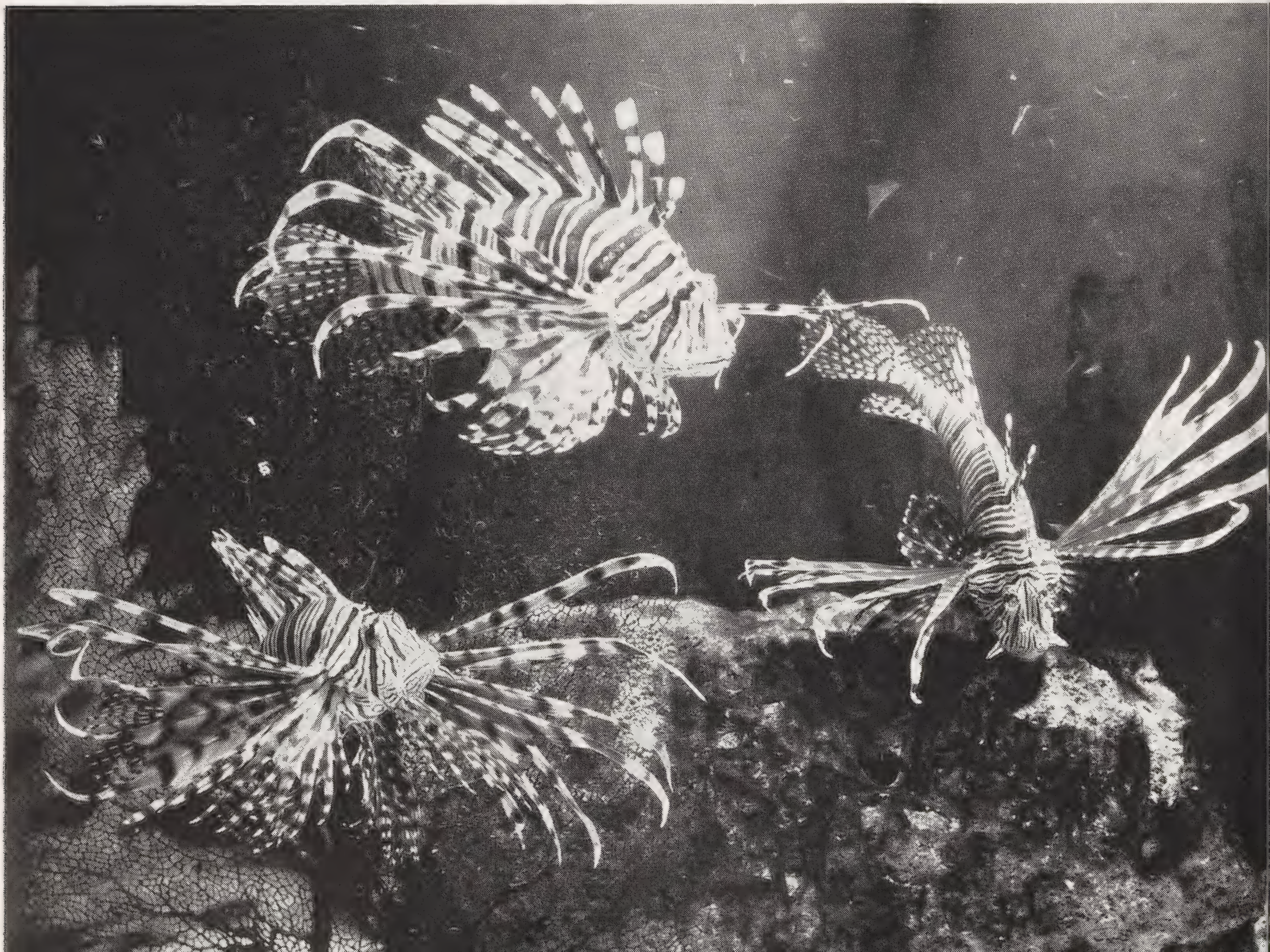
useful tool for both the physiologist and medical man. Drs. Robert Endean of the University of Queensland and Paul R. Saunders of the University of Southern California are carrying out research programs in which the venoms from several different kinds of marine animals, including the Zebra Fish, are being compared. At Dr. Ross F. Nigrelli's symposium on "Biochemistry and Pharmacology of Compounds Derived from Marine Organisms," held in New York in 1960, Dr. Saunders pointed out that he has found that the venoms of the Zebra Fish and Stonefish are remarkably similar. Yet the Stonefish is the most venomous of all fishes and a proved man-killer.

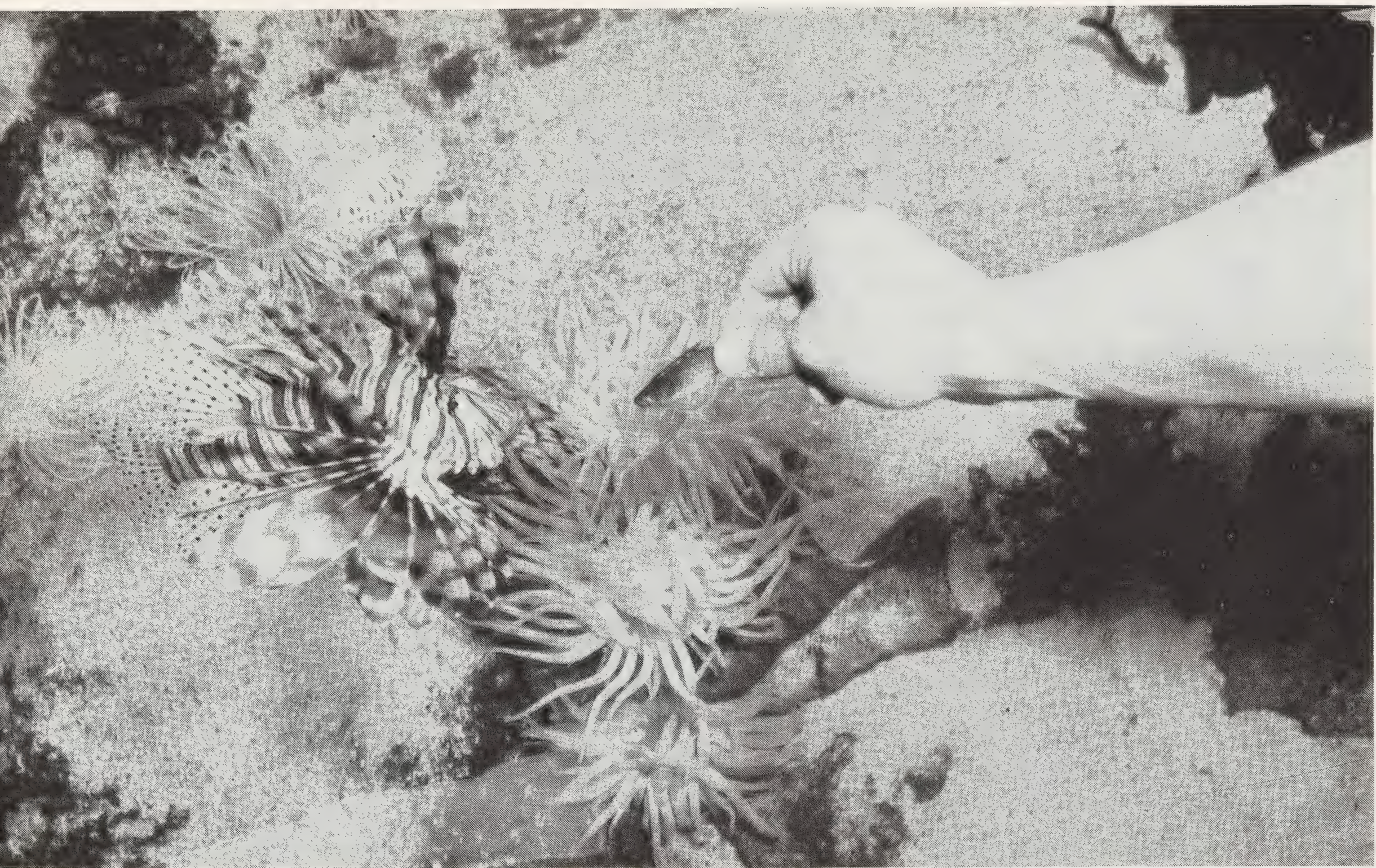
Dr. Saunders suggested that the well developed sacs filled with venom, which lie on each side of the Stonefish's spines, provide the key to why it is more dangerous than the Zebra Fish, because they deliver so much more venom into the wound.

The anatomy of the Zebra Fish's venom apparatus was first described more than eighty years ago, but only within the past few years have we realized that the fish exhibits appropriate behavior to go with it. A Zebra Fish does not passively wait for the enemy to attack it and become impaled on its spines, but actively tries to stick its adversary with well directed jabs. Its first reaction is to direct its fully erected dorsal spines at the aggressor. Reach out your hand toward a Zebra Fish or, much more sensibly, gently poke a stick at it and you are sure to find its spines pointed at you. No matter how you approach the fish — from the side, the back, the front — you are faced with 13 formidable spines. The maneuverability of the fish is truly remarkable and it will do head-stands, lie on its side, everything except turn upside down in order to keep its dorsal fin pointed in the proper direction. When the intruding object gets close, the fish suddenly jabs at it. Since the spines point dorsally, an effective jab entails movement in that direction — not an easy feat for a fish, which is

built primarily to go ahead. At the Cleveland Aquarium, E. M. Watson and Richard Segedi took movies, some of them in slow motion, of one of their Zebra Fishes on the defense. One has a first impression from the film that the fish thrusts its back up with a convulsive arching motion, but this is at least partly an illusion, and the effect may be obtained by rapidly elevating the posterior end of the body, which the fish can do by means of certain vigorous undulations of its caudal fin. Director William E. Kelley of the Cleveland Aquarium has pointed out that the big pectoral fins are spread wide at this time and undoubtedly act as a sea anchor to provide the resistance necessary for any sudden movement in mid-water and that they are ideally located to counteract a thrust in the direction of the fish's back. These fins could also act as the fulcrum for the rotational motion mentioned above in which

Right — The interest of this Zebra Fish in the small dead fish being offered to it is apparent. We take care not to overfeed, for Zebra Fish have actually been known to eat until they were sick. Below — Juvenile specimens, captured when quite small. Practically nothing is known about the reproduction of the Zebra Fish, except that many tiny eggs are laid in two balloon-like masses of jelly, which float.





the tail is quickly raised, and the head is lowered.

Man is not the primary enemy of the Zebra Fish; other fishes are, and it was undoubtedly to ward off their attacks that the Zebra Fish evolved its venom-bearing spines. A few months ago we had a good demonstration of the effectiveness of Zebra Fish defenses. We have always kept Zebra Fishes together, because they never reacted aggressively toward each other; in fact, they pretty much seemed to ignore their fellows. For this reason, when we obtained some babies, hardly three inches long, we decided to put them into a large tank containing two 8-inch specimens. As soon as the larger fish saw the small ones, they started to stalk them. There was no mistaking their intentions; the newcomers evidently looked like something to eat. The small fish were also aware of their danger. Up went their dorsal spines and down went their heads. Whenever a larger fish approached a baby, it was greeted with a battery of erected spines. Not one of the babies was attacked. Unfortunately, no scientist has ever tested the effect that Zebra Fish venom has on fishes, but we can safely assume that it is an adverse one. It would be most interesting to know whether it is more or less effective on fishes

than it is on mammals.

Any fish as bizarre and bold as the Zebra Fish could not long remain unnoticed, and there are written references to it nearly three hundred years old. A good measure of its recognition by people all over the world is the large number of popular names it has acquired. A list of those in English alone would be a long one. One of the most widely known of its many names is Turkey Fish, which seems appropriate for a fish with "feathers" that, as the late Albert W. Herre put it, struts about defiant of all other aquatic life. Less apt, but even more widespread, especially among fish fanciers, is Lion Fish. In Australia, Butterfly Cod is the term most generally used, although the fish is not at all closely related to the codfishes. Other, more or less descriptive, appellations that have been given to the species are: Butterfly Fish, Featherfins or Feather Fish, Chicken Fish, Tiger Fish, Dragon Fish, Stingfish, Firefish, Firecracker and Devil Fish.

For a fish as distinctive as the Zebra Fish, surprisingly little is known about its life history or classification. This may be so because it has no commercial importance except in Japan, where it is a food fish. The experts are generally agreed

that the scientific name of the species most often seen in captivity, at least up to a few years ago, is *Pterois volitans*, and it is this species about which we have been writing. Four or five different species are generally recognized as members of the genus, but definitive taxonomic work has not yet been attempted, and until such a comprehensive study is made, the exact status and definition of genus and species will remain in doubt.

The Zebra Fish, *Pterois volitans*, has been reported from a large part of the shallow, tropical waters of the Indian and Pacific oceans, an area that stretches all the way from the Red Sea and the east coast of Africa eastward to the Philippines, the Riu Kius, Australia and many of the mid-Pacific islands. At the southern limit of its range, on the South African coast, it occurs regularly in water of 60° F., but when the temperature drops to 50° F. dead specimens appear on shore. The fish is a characteristic inhabitant of coral reefs, but is also found in more open waters over flat, sandy bottoms. It is not always out in the open, however, being found in crevices or under ledges where, if its behavior in captivity is any indication, it rests upside down. At the Shedd Aquarium and in our own, specimens of Zebra Fish have been known to rest upside down under projecting parts of their tanks.

Nothing is known about the reproductive behavior of the Zebra Fish, and very little about its development or feeding habits. Most captive specimens at first will only eat living prey, but they can usually be trained to eat non-living foods such as pieces of raw fish, clam and shrimp. The food is slowly followed and when close enough is suddenly engulfed with a short "pounce" accompanied by a snap of the large mouth. In nature, crabs and shrimp seem to be its usual food. It has been suggested that Zebra Fish use their long, filamentous pectoral fins as lures and also as nets to trap their prey, but no description of this behavior has as yet been recorded. Such usefulness would certainly help explain the development of these seemingly over-sized fins whose function has been a puzzle since the days when early naturalists assumed they must be used in gliding flight above the surface of the sea. Perhaps the story of their evolution is one of harmonious development as an aid in feeding, as a warning device to advertise its owner's venomous qualities,

and as a mechanical platform to make possible the dorsal jab by which the fish defends itself.

It is also possible that the *dorsal* spines may serve to attract prospective prey when waved slowly from side to side. The first Zebra Fish the Aquarium ever had was observed to lure killifish successfully in this manner while resting on the bottom of its tank. Later on this specimen fed in mid-water, and it excited a most peculiar reaction in the killies it fed upon. Instead of fleeing as the Zebra Fish slowly approached, the small fish would remain as if transfixed, trembling violently. Some of our tankmen were certain that the larger fish had hypnotized the smaller, and although such an explanation is unquestionably not correct, neither Dr. C. M. Breder, Jr., who was Research Associate of the Aquarium at the time, nor anyone else who witnessed the performance could offer any sensible explanation for it. The fact that similar behavior has not been noted since 1931, even though no systematic attempt has been made to do so, beclouds the situation still more.

I am sure that there are other strange and wonderful things to be found out about the Zebra Fish. Take the following recent discovery, for instance. For some time we had noted that the water in our Zebra Fish tank would periodically, but at irregular intervals, become spotted with tiny white gossamer-like bits of material. Dr. Nigrelli examined some of these and found that they were pieces of fish skin. Evidently our Zebra Fish were shedding their skins—a most unfish-like thing to do. Had the fish not obviously been so healthy, we would likely have considered their action as a manifestation of disease. Dr. Nigrelli was preparing to publish a report on this remarkable phenomenon when we learned that Dr. Yoshitsugu Hirosaki had observed the same thing in the Enoshima Aquarium and that his article about it had just been published in Japan. What the significance of this skin-shedding is and what causes it, all of us have yet to find out.

When Aquarium visitors suddenly stop and, after a moment's confusion, start to marvel at the Zebra Fish, they are doing—although for different reasons—just what ichthyologists and professional aquarium men have been doing for years. And will keep on doing for years to come.

SOME LIKE IT HOT— SOME LIKE IT COLD

By HERNDON G. DOWLING

Curator of Reptiles

REPTILES ARE COMMONLY THOUGHT OF as “cold-blooded” animals. With such an appellation, people expect them to be cold to the touch, and slimy as well. Actually, the term cold-blooded has nothing to do with the temperature of the animal, but instead refers to the fact that reptiles obtain a negligible amount of heat from their internal metabolic processes and must rely instead on external sources of heat for body warmth. This common mistake in the meaning of “cold-blooded” has caused many biologists to prefer the less familiar but more apt term *ectothermic* (outside heat) to describe such animals. The contrasting term *endothermic* (in-

side heat) is used for animals such as ourselves, other mammals, and birds, which produce most of their own body heat by internal means.

As a matter of fact most snakes do feel relatively cool (though certainly not slimy) to the touch, since the temperatures that they commonly maintain are lower than the 90 to 95 degrees of an endothermic human's hand. This is not true of lizards, however. Many of them maintain

The Collared Lizard of the arid Southwest is one of those that like it hot. It needs a temperature of 95° before it becomes active, and can stand 108°—enough to kill many reptiles.





The Fence Swift is one of the spiny lizard group whose activity temperature is near 95 degrees, whether it lives on the desert or in the mountains. It maintains this heat by differential exposure to the sunlight.

temperatures, at least during the hours that they are active, that would send you or me to the hospital.

Most people are surprised to discover that reptiles do not produce heat by internal means. Even after they learn this bit of information, they are not apt to be concerned about it or to realize its importance to these animals. The truth is, though, that the ability to find the right temperature is just as important to a reptile as is its ability to find the right food. Some reptiles probably spend more time and effort in search of heat than they do in any other activity. Being endotherms, ourselves, we find it difficult to appreciate the importance of heat. An ectotherm must obtain heat or perish. Without heat its muscles do not operate properly, its digestive system stops functioning and probably even its nervous system slows down to the point that it is no longer useful.

These things do not happen all at once, and this is one of the difficult things to explain to the uninitiated. A caiman may be able to swim around and even snap at its owner's hand in 68-degree water, but its temperature must be raised to 86 degrees before its digestive system begins to work properly.

Reptile keepers and curators are more knowledgeable than the general public in this respect but even so most of us still proceed under fairly simple rules that were worked out long before any precise information was available on the temperatures of reptiles in nature. The usual rule-of-thumb in this country is to keep local reptiles at ordinary room temperatures (68-76°) and to keep tropical reptiles warmer (80-86°). European

zoos have about the same rule-of-thumb, but their temperatures seem to average some five degrees less. Up to this date there are only a few cases where any of us have deviated from these long-standing procedures.

One reason that these procedures have been followed so long is, of course, that they work. At least they work for a considerable number of species — longevity records of ten to twenty years or more attest to this. Part of the reason for this is, of course, selection. The reptiles that are able to survive under the usual conditions of a reptile house are those that are generally displayed. This includes such large or spectacular reptiles as most of the boas and pythons, cobras, rattlesnakes and alligators as well as some lizards. Others, however, fail to survive. They refuse to eat at all, or they eat voraciously for a while and then die. After a few such experiences reptile curators label these species as "delicate" or "difficult" and no longer attempt to display them.

Nor is it surprising that the role of temperature regulation in the lives of reptiles is so little appreciated on other bases. The keeping of reptiles is an art that goes back for hundreds of years, while most of the information on their heat requirements has been learned in the last twenty. Further, some of the early laboratory experiments confused the issue so completely that we have not yet recovered from it. One early worker kept reptiles in his laboratory and produced a large number of measurements that demonstrated conclusively that, under these conditions, the temperature of the reptile remained near that of the air and substratum at all times. The data were

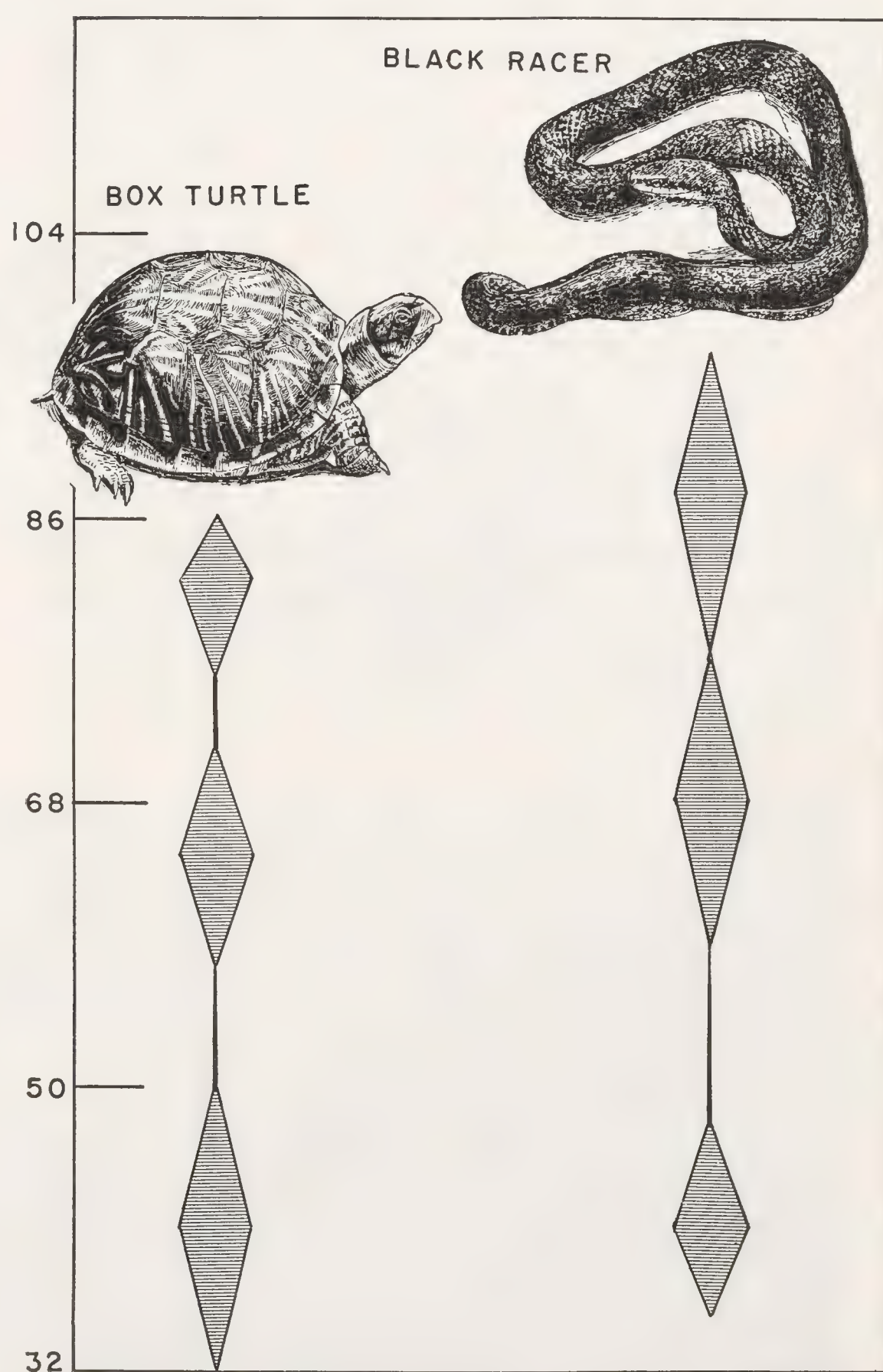
convincing enough and perfectly correct, but people have tended to forget that they were taken under "laboratory conditions" and not under the conditions of the animal as it was found in nature. Under laboratory conditions the reptiles had no sources of heat available other than the air and substratum, but if other sources had been present the results would have been far different.

Much of the present-day work on reptile temperatures was stimulated by a paper entitled, "A Preliminary Study of the Thermal Requirements of Desert Reptiles," published in 1944 by Raymond G. Cowles of the University of California at Los Angeles and Charles M. Bogert of the American Museum of Natural History in New York. These two workers, together with Robert C. Stebbins and his students at the University of California at Berkeley and Henry S. Fitch at the University of Kansas, have contributed the major information that we have up to now.

Their work has laid the basis for the consideration of temperatures in the maintaining of any reptile collection but the information is still too meager to be used in a direct fashion on any but a very few species. Of the some 6,500 species of living reptiles, we now have some temperature information on perhaps 100. The data gathered so far will allow us to make an educated guess as to the temperatures of some others but for many reptiles, probably most, there is still no information available at all. Unfortunately, too, from the standpoint of a zoological park zoologist, most of the temperatures that have been obtained are for small lizards — forms that are seldom exhibited in reptile houses. We are still a long way from having the basic information necessary to provide proper temperatures for even the commonly-exhibited animals.

Nevertheless, the field data that we do have is extremely interesting. Before these observations were made, who would suppose that a desert lizard could be as much as 18 degrees warmer than the air surrounding it? High mountain lizards are even more adept at gathering heat. Some, on both sides of the world, have been recorded at 54 degrees higher than the air temperature — something that even some of the workers in this field found hard to believe until it was corroborated by additional observations.

Reptiles in nature obtain the required heat in two basic ways: They absorb it directly from the rays of the sun, a method much used by diurnal (day-active) lizards in the temperate zones, or they absorb it from the substratum, the rock, sand or other surface they lie on. This latter method is about the only one available to nocturnal (night-active) reptiles that hide during the day, and is used also by some diurnal kinds. This entails, particularly for desert reptiles which are exposed to extremes of temperature, gauging the exposure to sun and substratum carefully enough so as not to become overheated. By this kind of activity and by panting at near the upper limits



These reptiles vary between the activity and rest ranges in each 24 hrs. during summer, but remain in the hibernation range in winter. The latter is similar for all the reptiles studied. Wide points on the vertical lines indicate the important temperatures for each animal, those concerned with activity, rest, and hibernation.

of their heat tolerance, these lizards are able to maintain their body temperatures within a relatively small range of variation while the environment around them shows wide shifts. It should be emphasized, though, that this is particularly true of temperate-zone, arid-country reptiles. Many of the tropical reptiles, particularly those of the tropical rainforest, show little accommodation to shifts in temperature.

To complicate matters further, reptiles in general do not have one "normal temperature" but most of them have at least two "normals" and some have three.

The *activity temperature* (often called the "normal activity range") is the one that has received most of the attention so far. It is within this range of temperatures, often varying no more than 18 to 27 degrees, that the reptile ordinarily carries on its life's activities. In desert lizards this range may be very narrow, perhaps a variation of only 10 or 12 degrees. As mentioned before, however, the real "activity range" may be very difficult to establish. What is within the active range for the leg muscles of a reptile may be too low for its stomach movements — yet both

It is often bitter cold in the high Andes, but the False Swift (Liolaemus multiformis) raises its body temperature as much as 56° above its surroundings by sun-bathing on a tuft of grass.

are necessary for life. We have had this problem brought to our attention more than once in the Reptile House where we sometimes maintained temperatures that were high enough to allow a snake to eat a meal but too low to allow it to digest it.

The *rest temperatures* have received much less attention from field biologists but are probably as important to the reptiles (and thus to reptile keepers) as are the active temperatures. When the reptile is at rest, usually under cover, its body temperature falls considerably, usually about 25 degrees or more below the active level, to near that of the substratum. Some tropical reptiles that remain in trees obviously allow their body temperatures to fall with that of the general environment. Most reptiles, however, even in the tropics, tend to retire to some secluded and protected place at night. Whether or not these resting places are selected for their temperature levels appears to be completely unknown. It is known, however, that at least for some reptiles the normal active temperature becomes lethal if it is artificially maintained for a long period. Some recuperation of the animal's energy stores at a lower temperature seems to be required.

The *hibernation temperature* may be similarly important for some of the reptiles of the temperate zones. This level must be low enough to keep the reptile's metabolic rate down to a point

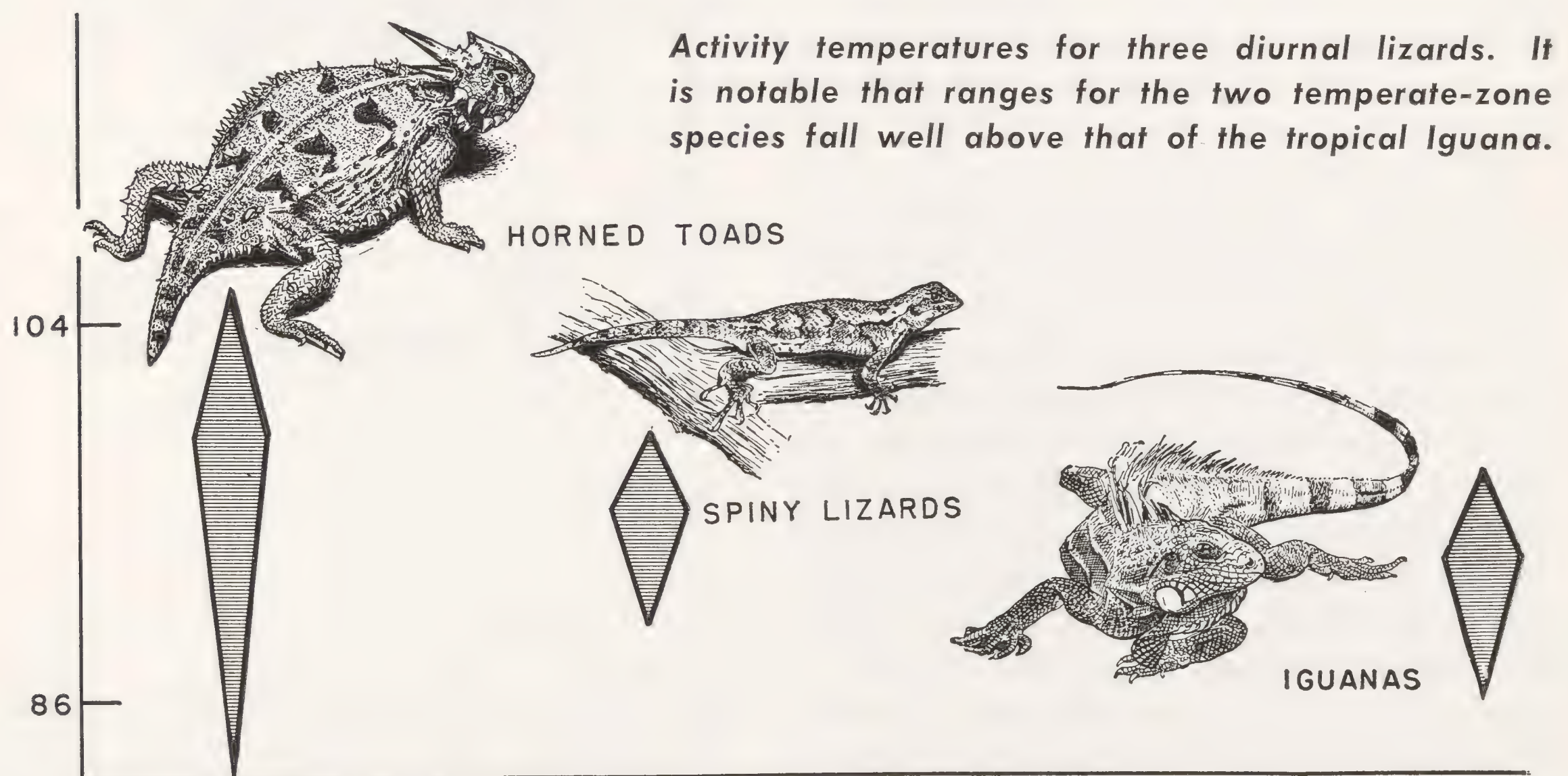


where the animal's energy reserves are not used up during the period of hibernation (roughly, the body metabolism doubles with each 18 degree rise of temperature). At the same time the body temperatures cannot descend to subfreezing levels. The actual hibernation temperatures are known for only a handful of reptiles.

WHEN WE LOOK at the records for the active temperatures of various reptiles we find a huge amount of variation. Temperatures exceeding 117 degrees for more than a few minutes

even the diurnal ones, that occupy a given region regularly maintain body temperatures at levels well below those of the lizards in the area.

Among those lizards that maintain the highest body temperatures are the common racerunners (*Cnemidophorus*) of North America. Their ordinary active temperatures range between 98 degrees (about that of a man) and 110°, with an average of about 106°. The temperatures of other members of the family Teiidae (which is restricted to the New World) do not appear to have been recorded but the noonday activity



mean death for any reptile but some commonly maintain their activity temperatures within a few degrees of this. Others are far down the scale and begin to show extreme discomfort if the temperatures rise to the 77 degree mark. Both of these are extreme cases, however. The activity temperatures of most reptiles that have been studied lie between 77 and 104 degrees.

The reptiles that maintain high body temperatures are, of course, all diurnal in habit. However, the mere fact that a reptile is diurnal does not mean that it will necessarily maintain a high body temperature. One of the most interesting aspects of the whole problem is that several reptiles in what would seem to be the same environment may be occupying completely different temperature ranges. Another interesting observation is that, for some unknown reason, the snakes,

periods of the jungle runners (*Ameiva*) and tegus (*Tupinambis*) and their violently active, bird-like movements in nature suggest that they, too, operate at these high temperatures. This high rate of activity is correlated with an exceedingly brief period, however. Racerunners and jungle runners seldom appear from their burrows before ten in the morning and have usually returned to them before three in the afternoon. The ecologically and physically similar lacertid lizards of the Old World maintain similarly high active temperatures. The three species that were studied by Stebbins in Africa all had about the same range (95-108°) as that of *Cnemidophorus*.

Some of the desert species of the family Iguanidae maintain body temperatures almost as high as those of the teiids and lacertids. The Collared Lizards (*Crotaphytus*, 95-108°) and

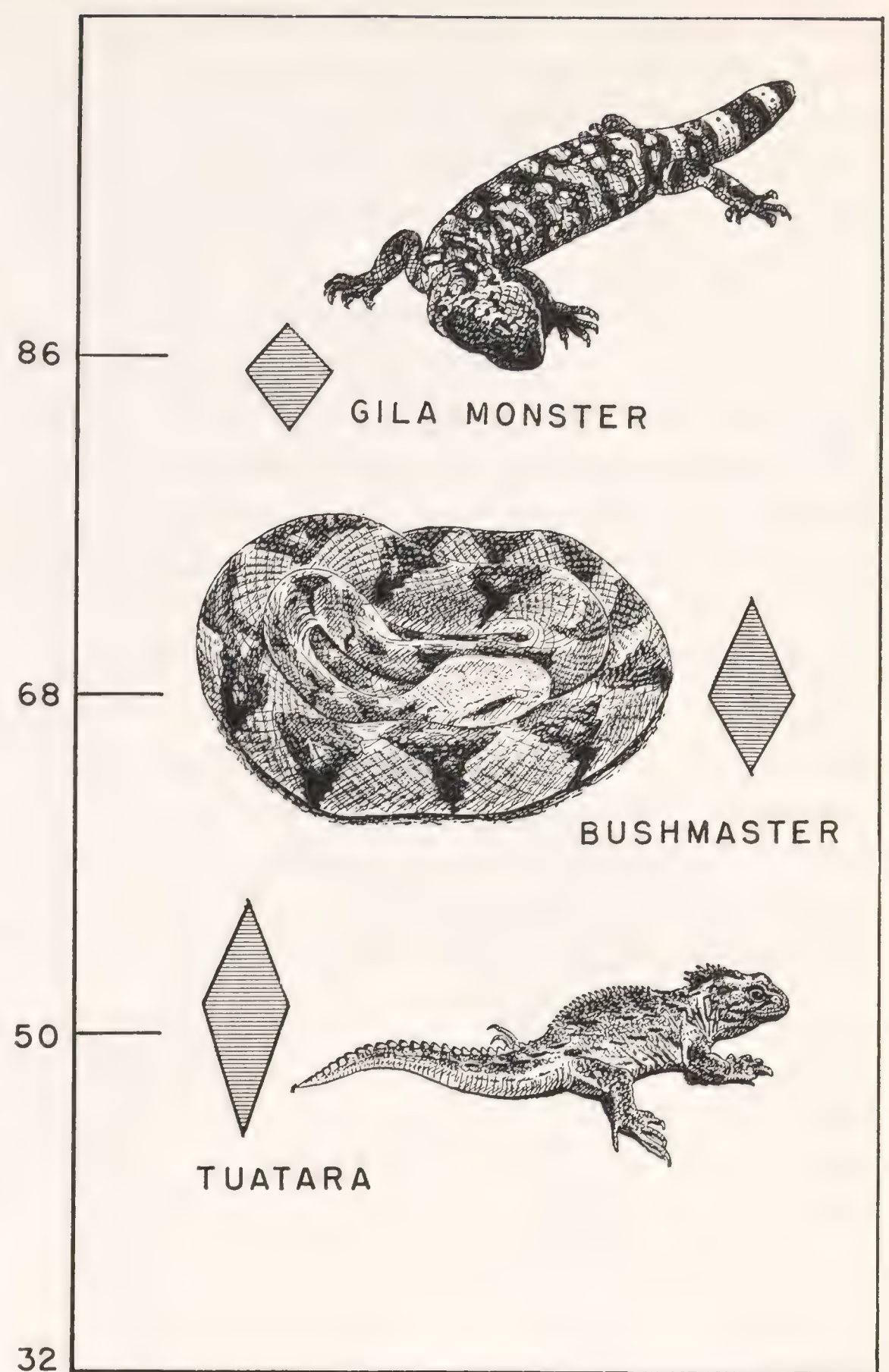
Fringe-toed Lizards (*Uma*, 79-106°) are examples of these. However, other members of this wide-ranging and variable family of American lizards have different habits and maintain body temperatures in the eighties.

As previously indicated, the temperatures of snakes fall below those of the really "hot" lizards. The warmest snakes that we have records of are the common North American racers. The activity temperatures of Coachwhips (*Masticophis*) have been recorded at a range of 76 to 98 degrees, averaging about 91°. The closely related Blacksnake (*Coluber*) was recorded at about the same range (77-97°) but averaged a little cooler (88°). The Bullsnafe (*Pituophis*) seems to fall in this same class. Most other snakes, however, operate at lower temperatures.

To turn to the other end of the spectrum, we must mention the Tuatara (*Sphenodon*). This unique reptile lives on small, foggy islets off New Zealand. It is nocturnal in habit and the temperatures obtained by William Dawbin in nature (and reported by Charles Bogert) ranged between 46 and 56 degrees. To complicate the problem, though, Robert Stebbins found that his Tuataras in the laboratory appeared to select a temperature nearer 64 degrees when given the opportunity. Similarly, we have found that our specimen appears more active and alert and in better color at about that temperature. Can it be that the Tuataras never attain their preferred body temperature in nature? Or is it that they attain this temperature at some period not observed by Mr. Dawbin? A similar question can be raised about the temperatures of crocodilians.

In any case, Mr. Dawbin has pointed out that the low temperature range is not characteristic of the Tuatara alone but is shared also by two nocturnal geckos that inhabit these same islands. This adaptation would seem to be a problem of ecology, therefore, rather than some ancient inheritance.

Most nocturnal reptiles have activity temperatures that range below those of their diurnal counterparts. Such nocturnal reptiles include most geckos, most viperid snakes, some boids, and individual species of many other families of reptiles. For nearly all of these the active temperatures fall at 86° or below. The extremely low range (64-74°) for the Bushmaster has already



Activity temperatures for three nocturnal reptiles. That of the Tuatara is near the minimum for reptiles, that of the Gila Monster is near the maximum for species active at night.

been sufficiently emphasized (see *Animal Kingdom*, Sept.-Oct., 1961).

The few observations on the temperatures of crocodilians, which are nocturnal, present a peculiar problem. The work of Colbert, Cowles and Bogert on the American Alligator indicated that the "preferred basking temperature" of that reptile was somewhere in the 90-95° range. Yet, recent temperature measurements of the Nile Crocodile in nature by Hugh Cott give a range of only 74-84° for that reptile. Thus, either we are asked to believe that our temperate-zone alligator has temperature requirements 12 or 14 degrees above that of the tropical crocodile or that actually the two sets of observations were measuring different things. More work will have

to be done before this problem is settled but it seems quite likely that the latter is the case. It seems possible that at least in these nocturnal animals the activity temperatures are lower than the "resting" (basking) temperatures. They do their hunting at night when their body temperatures are at 77 or 79 degrees and then bask during the day and raise their body temperatures into the nineties—an activity that would obviously aid them in digestion. This habit might be equally true of Copperheads and rattlesnakes. But is this the right answer? We just do not know.

THE STUDIES of reptile temperatures in the field and in the laboratory are extremely interesting but, as has already been mentioned, few of the observations are directly applicable to problems of maintaining the collections of native and exotic reptiles found in most zoological parks. Perhaps one of the most important results of these studies is to make us more alert to the problems of temperature and to take these needs into consideration when dealing with one of the "difficult" species. Further, it may help us find out why some particular compartments are "good" for boas or pythons while others are better for the maintenance of Copperheads or rattlers.

Some of the observations, of course, are directly applicable. The high temperature requirements of racerunners, desert iguanas, and Collared Lizards are sufficient in themselves to explain why these species are seldom exhibited in other than southwestern zoos. Similarly, the extremely low requirements of the Tuatara, the Bushmaster and other nocturnal reptiles helps to explain the common difficulties encountered in attempting to exhibit them.

Further, the observations on one species can often (though not always) be extended to closely related kinds. Charles Bogert has shown vividly how similar the various species of Spiny Lizards (*Sceloporus*) are in their heat requirements, although they may occupy what appear to be totally dissimilar habitats. The same is true of the racerunners and it seems possible that in some cases similar temperature requirements may be characteristic of most of the members of an entire family. At any rate, the studies have given us some base to start from.

Another point that these studies have empha-

sized is the necessity of a daily variation in temperatures for lizards, at least, and probably for all reptiles. No reptile house, to my knowledge, has such a diurnal variation built into its heating system. Certainly, however, it should be seriously considered in any structures planned for the future.

Some park curators are apt to complain, "But we are not really doing as badly as these studies would suggest. We keep a standard temperature of 80° and keep reptiles with all kinds of requirements." This may be true, but in most cases it merely means that we really do not know what the actual temperatures are for the reptiles in the various enclosures. An example from our own Reptile House illustrates this.

Of several different areas in the Reptile House, we have one, the "cool section," where we make a concerted attempt to control the temperatures. This section includes several exhibits, mostly of amphibians but also of our valuable Tuatara. In a recent check of the conditions here I found that the thermometer in the enclosure was registering 70° (somewhat too warm). The actual air temperature in the cage when measured by a more accurate thermometer was 76° (much too high) but I also discovered that the Tuatara was maintaining a body temperature of 66° (about right) by sitting in its water dish. And this was in our "controlled" section!

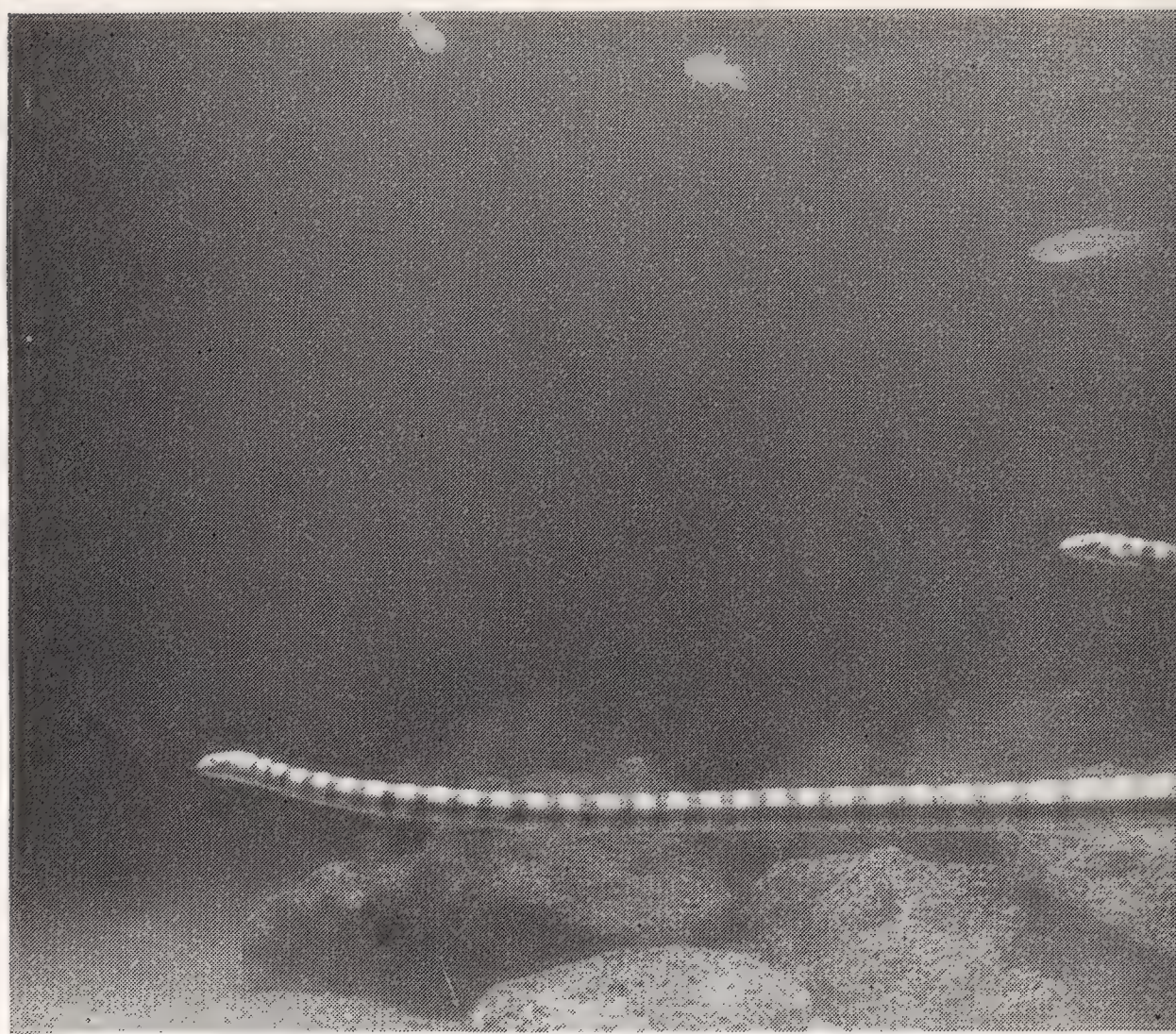
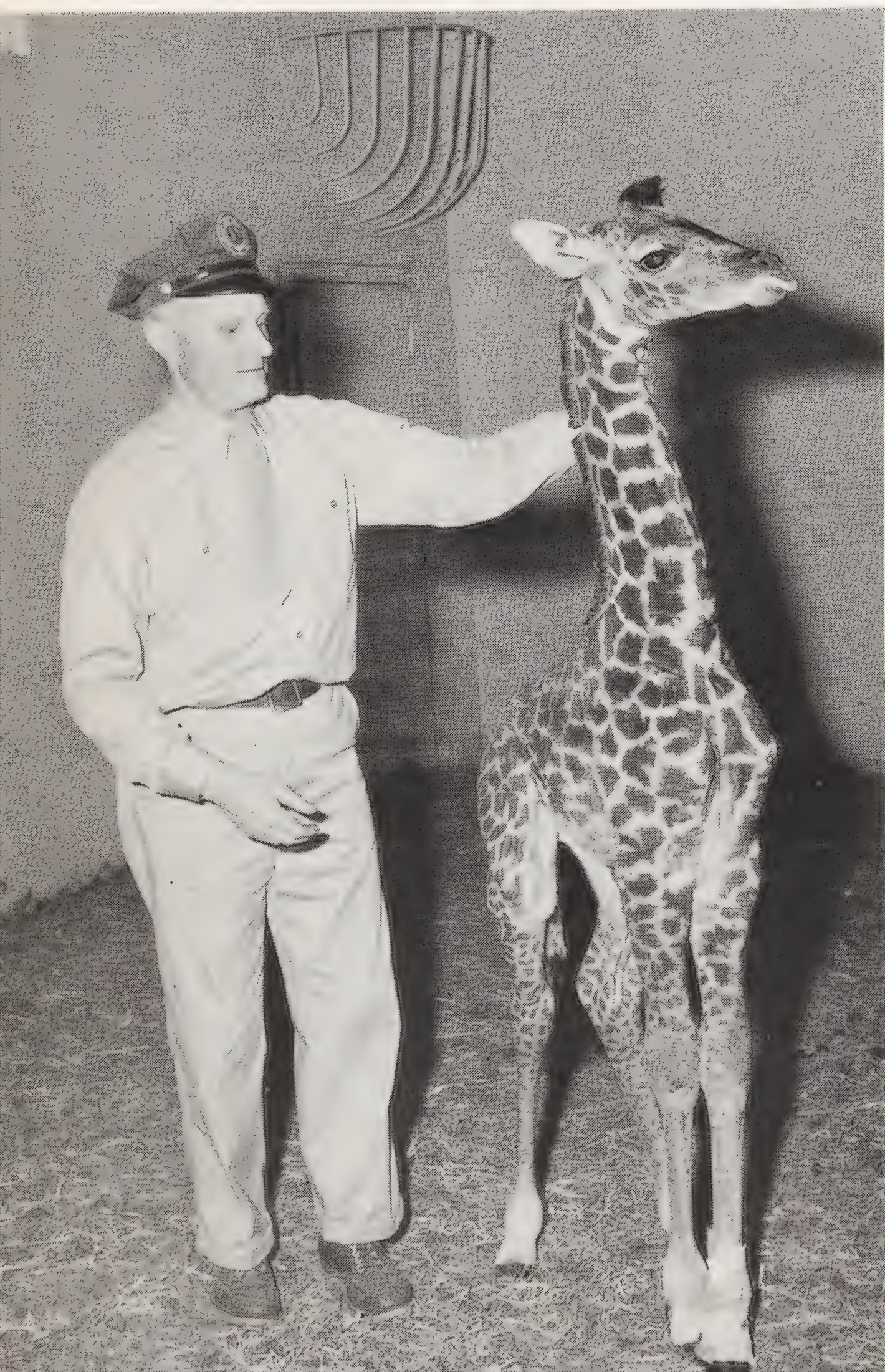
This brings up the final point, that if given the opportunity many reptiles will select the proper temperature. "Spot heating" by sunlamps or hot-water coils can overcome many of the shortcomings of our temperature controls. The availability of tempered water, warm (80-86°) for tropical crocodiles and anacondas, cool (68-77°) for native watersnakes and turtles, can be equally important. This is by no means a cure-all, however. Many tropical reptiles are not adapted to select their positions on the basis of temperature. Some of the nocturnal rainforest kinds will roast in a dark hideaway over a heating coil rather than expose themselves. Similarly some diurnal reptiles will move away from a properly heated area in order to get into stronger light. And so it goes.

Sometimes it seems that more information about reptile requirements is not really helpful. It just makes things more complicated!

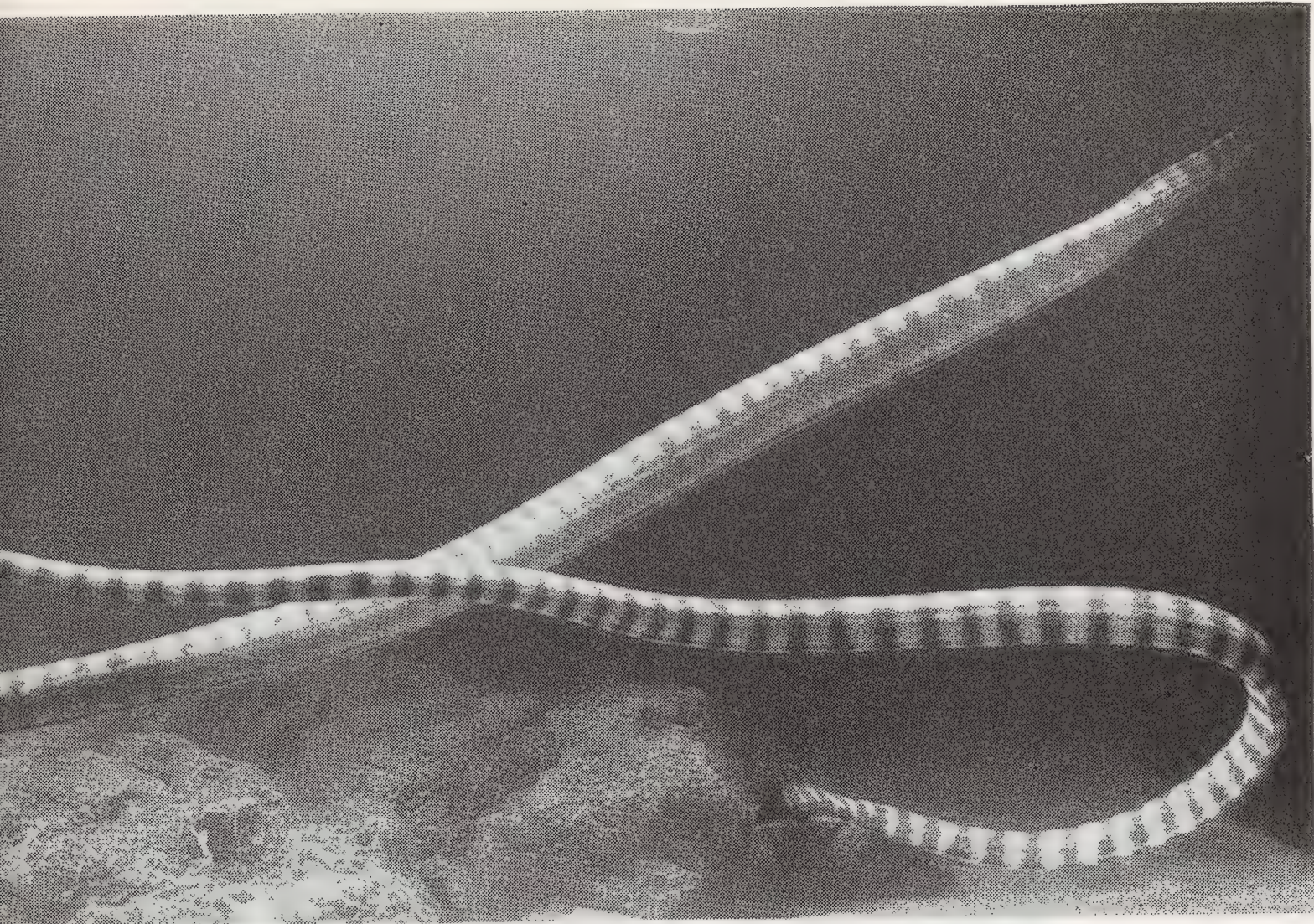
Zoo News In Pictures

Photographs by Sam Dutton

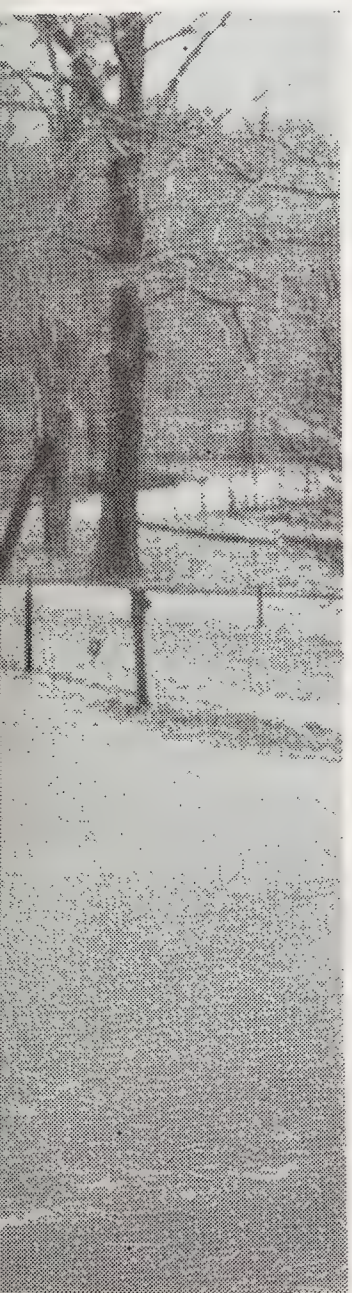
For the first time in 30 years we have a Giraffe baby in the Zoological Park. This baby was born of Masai parents on March 3, stands 5 ft. 7 in. high and weighs about 100 lbs. At first the mother was nervous and tranquilizers were administered. Here Keeper Foster shows the unafraid baby.



Early on the morning of March 3, 1964, Keeper Foster found a newborn giraffe. He took it to his home and kept it for 2-hour intervals for the first 24 hours and later this spring.



The Aquarium is exhibiting specimens of the Blue-ringed Sea-snake (*Hydrophis cyanocinctus*) recently arrived from Bombay. One has shed three times, but so far we cannot induce them to eat.

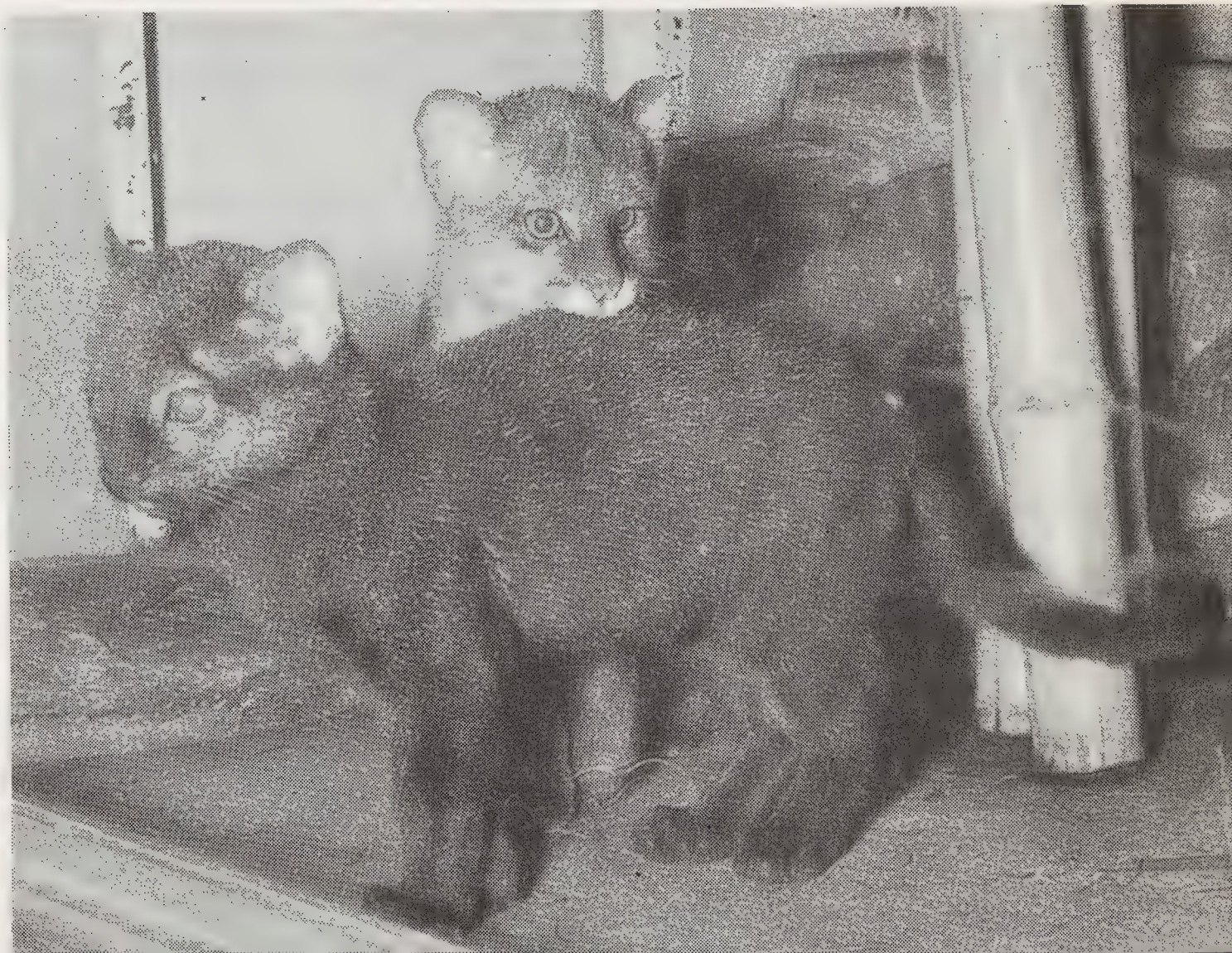


ch 7 Keeper Richard Herdick in the corral — weak, unable by its mother. For two weeks g Island every night, fed it at few days. Now it is thriving resident of the Children's Zoo.



Interesting additions to the Red Light Room in the Small Mammal House are a Tamandua mother and baby from the American tropics. They arrived March 2 and by now are accustomed to the reversal of night-and-day.

One is black and one is red — but they are both Jaguarundis from the American tropics. At one time it was thought that the different colors represented different species, but now it is known that they are only color phases and that they may occur in the same litter.



BIRD WATCHING IN EAST AFRICA

By JOHN WILLIAMS

Ornithologist, Coryndon Museum, Nairobi

In the last issue of ANIMAL KINGDOM we announced a "Bird Watchers' Safari" to Kenya, Uganda and Tanganyika from June 7 to July 17. To give some idea of the wealth of bird life in that vast area, we asked the ornithologist of the Coryndon Museum, who will lead the safari, to tell something about the possibilities. Judging from his article, they are almost unlimited.

ON JULY 8, 1961, three bird men paused for refreshment in the shade of a spreading fig tree, near the bottom of the wild Kongelai Escarpment in the West Suk country of western Kenya. The party consisted of Burt L. Monroe, ornithological section leader of the 1961 du Pont Zoological Expedition; Tony Dyer, an ornithologically-minded white hunter; and myself.

Above us, to the west, rose the towering cliffs flanking the escarpment, over which two Verreaux's Eagles soared effortlessly — easily recognized even at a distance by their characteristic wing silhouettes, the wings narrowing abruptly where they joined the body. To the north and east was apparently unending savannah woodland like a verdant carpet, broken only where



patches of red sandy soil showed through at dongas or rocky outcrops and chimney-like giant termite hills towered over the treetops.

In the far distance, merging into mirage and mauve heat haze, we could just make out the outline of the great massif of the Debasien Range, its forests and mountain grasslands still largely unexplored from the zoological and botanical point of view. What a challenge this area will be to some fortunate naturalist of the future!

Over our lunch — pleasantly interrupted at intervals to snatch up binoculars and identify some new bird which had appeared — we discussed the bird-life we had observed that morning and the fantastic abundance of birds which surrounded us. Shortly after dawn we had reached a point in the Cherengani mountains, north of the Kongelai Scarp, high above the rain forest and nearly in the clouds. Standing on the very brink of a precipice we had little time for the breathtaking grandeur of the broken, mountainous country below us, for a dozen or more of one of Africa's rarest swifts, the aptly named Scarce Swift (*Apus myoptilus*), streaked by within feet of our heads. These were the aristocrats of a mixed assembly which included many of the giant Mottled and Alpine species, a multitude of Nyanza Swifts and



a sprinkling of White-rumped Swifts. With so many species in evidence at one time we looked, alas in vain, for that mystery bird, Reichenow's Swift, described from the vicinity of Doi Inyo Erok mountain in southern Kenya in 1908 and never seen since. Earlier in the expedition Burt Monroe had said "I'm usually lucky with swifts" — and so he was, discovering Sabine's Spinetail in the Kakamega Forest, a first record for Kenya. And now he was attracting *Apus myoptilus* as a mercury vapor lamp attracts moths! A pity his powers did not extend to *Apus reichenowi*.

As it grew lighter and the cloud cover dispersed, from below us in the forest came the calls of many birds. First to break silence was the early morning song of some species of Robin-Chat, followed soon after by the liquid double notes of a Black-winged Oriole, an uncommon bird distinguished from other kinds of black-headed orioles by its wholly black central tail feathers. Intermingled with the oriole's calls were the distinct bell-like flutings of a pair of Doherty's Bush-Shrikes. This skulker of the forest undergrowth is a gorgeous green, crimson, yellow and black creature whose beauty is seldom seen. During the Mau Mau emergency in Kenya, forest gangsters often imitated the call, using it as a danger sig-

nal. From a thicket of orange-flowered *Leonotis* came the noisy scolding of Tacazze and Green-headed Sunbirds, the former long-tailed and resplendent in glittering metallic purples, mauves and bronze as the sunlight caught his plumage. A small party of Masai Red-headed Parrots flew swift and direct above us, giving a typical parrot type of call; below them in the forest came an answering throaty "gorh, gorh, gorh, gorh, gorh, gorh, gorh" from a family of Hartlaub's Touracos — pigeon-sized green-and-deep-blue birds with contrasting and conspicuous crimson flight feathers.

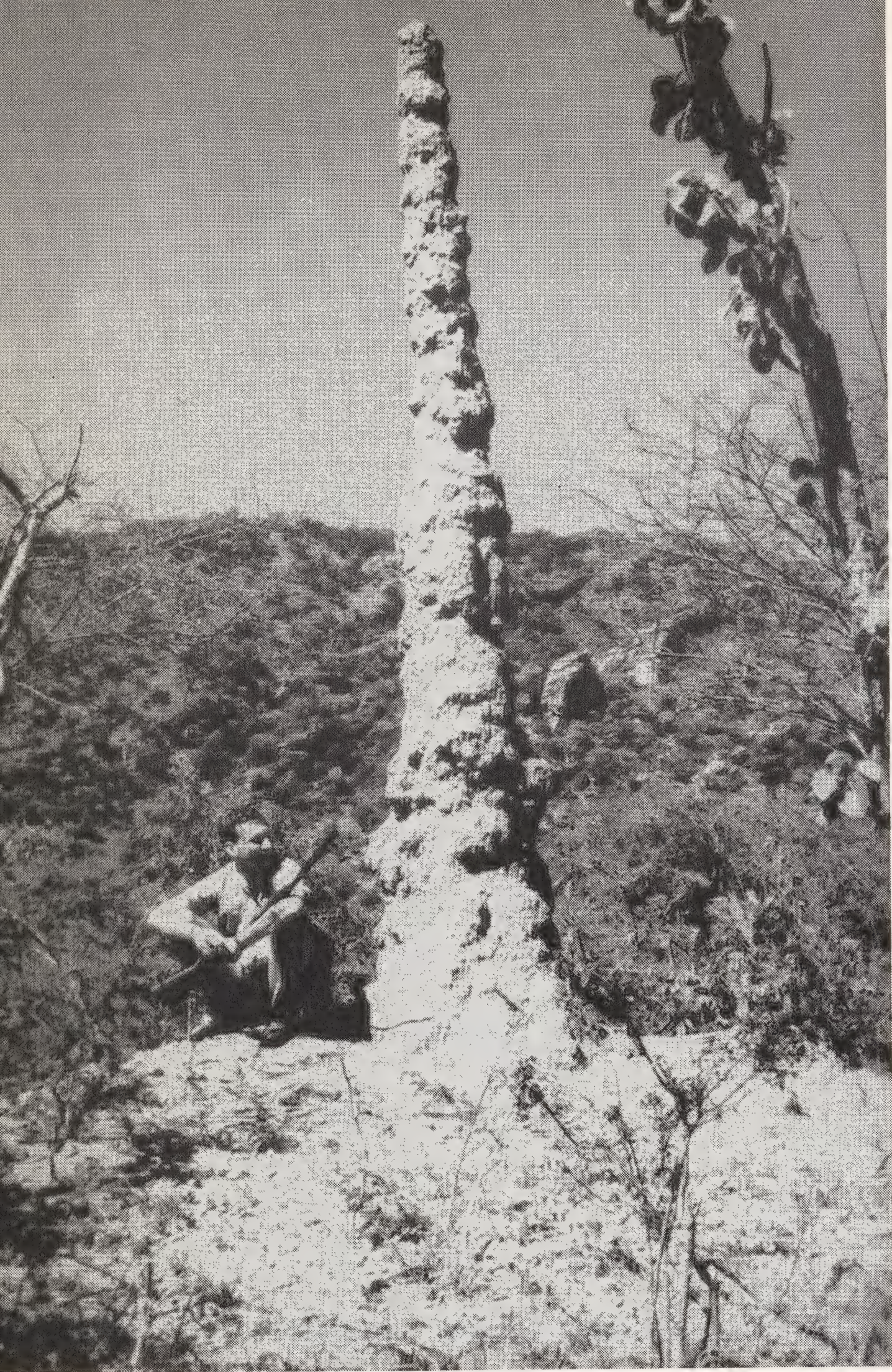
Later in the morning we saw a rarer and much more local species of touraco, the White-headed Touraco. A small flock of these birds was playing at follow-my-leader along the course of a streamlet which meandered down the escarp-

Lesser Flamingos on Lake Nakuru have been called "the greatest bird spectacle in the world," and estimates of their numbers go as high as a million or more individuals.

ment, flying one after the other from tree to tree. We were torn from our enjoyment of watching the White-headed Touracos by the sudden appearance of a family party of Stone Partridges, scurrying up the slope of a granite outcrop. They looked remarkably like little bantam chickens, with their rapid movements and tails held aloft.

And so we came to our midday stop below the fig tree and relaxed a while, delighting in the continuing wildlife spectacle all around us. In spite of the noontime lull in avian activity there was still much to see. Growing in a nearby acacia tree was a great hanging mass of the mistletoe-like parasite *Loranthus*, with clusters of red and yellow, many-stamened flowers. Feeding on the nectar and tiny insects afforded by the blossom was a male Mariqua Sunbird, shining bronze-green with a maroon breast band. Flashes of even brighter plumage revealed a male Black-bellied Beautiful Sunbird, again shimmering green, but with long central tail feathers and a scarlet breast patch bordered on each side by yellow. As these birds moved about feeding they disturbed several brilliant blue lycaenid butterflies of the genus *Epamera*, whose larvae feed upon the leaves and flowers of the *Loranthus*.

Many other birds were also attracted to these



Gigantic, chimney-like termite mounds actually tower above the treetops in some areas. This typical example is at the base of the Kongelai Escarpment, one of the birding areas.

Photo by G. Lucas

flowering or fruiting parasitic clumps. Several barbets, from the tiny Red-fronted Tinker-bird to the larger Red-fronted, White-headed and Spotted-flanked Barbets found sustenance much to their liking. In the fruiting fig above us there was less activity, but the figs still brought in small numbers of Blue-naped Mouse-birds and Yellow-vented Bulbuls. A pair of spotted-winged Jackson's Hornbills, after deciding that we were harmless, also arrived for a snack. The savannah woodlands around us were rich in hornbills, from the turkey-like Ground Hornbills to the various small savannah species. Not very far away we could hear another Jackson's, or it may have been a Red-beaked Hornbill, indulging in an ecstasy of

display, raising his wings and lowering his head, at the same time emitting an excited, harsh, rapid "ah, ah, ah, ah, ah, ah, ah, ah, ah, ah." All this for the benefit of an apparently uninterested female sitting quietly below him.

Burt seemed almost awestruck by the wealth of bird-life and his enthusiasm knew no bounds. "I have travelled widely in America, and in New Zealand and Australia and elsewhere," he said, "but nowhere did I ever encounter such a variety and profusion of birds with such ease as I have done in East Africa." He had discovered the appeal of East African birds — their diversity and abundance, and also their extreme accessibility. The avifaunal wonders of regions such as New Guinea or the basin of the Amazon, Peru or Ecuador may partially eclipse those of eastern Africa, but in all these countries many of the best bird haunts are difficult to reach, and much of the avifauna is forest treetop species difficult to observe except as dark silhouettes. No such problems arise in the three East African territories, where even an elderly person may travel about in comfort visiting a great variety of different habitats and seeing an almost bewildering galaxy of birds.

With the exception of the most densely populated areas, where almost complete eradication of natural habitat has exterminated all but a few species, birds are to be found in abundance everywhere. In the relatively small country of Kenya a total of one thousand and thirty-two species of birds has been recorded, a number which will undoubtedly be increased in the future when the remaining zoologically unexplored forests and mountains have been investigated. Over the whole of eastern Africa the number of resident and migrant bird species is nearly fifteen hundred.

To give some idea of the diversity of habitat and the wealth of wildlife I am listing just a few of the birding localities which lie within a day's journey from Nairobi. In Nairobi district itself the Airport is well worth a visit. In the grasslands around it and on the perimeter fence may be seen the local and elusive Cuckoo Weaver — its field appearance is that of a short-tailed Serin with a black bill — which lays its eggs in the nests of *Cisticola* warblers. In the same area three species of long-claw exist side by side, the Yellow-throated Long-claw — so like an American Meadow Lark both in appearance and song — and the

rarer Pangani Long-claw and the beautiful Rosy-breasted Long-claw. Within a few minutes by car from the city center are two forested areas, Karura Forest and Langata Forest. Both are excellent for birds and such species as Narina Trogon, Black Cuckoo-Shrike, Amethyst Sunbird, Cuckoo Falcon, Violet-backed Starling and Hartlaub's Touraco are common. The call of the brilliant Emerald Cuckoo — a distinct "hello Judy" — is constantly heard. Several large birds of prey nest in these forests, among them the Hooded and White-backed Vultures, the rare Ayres' Hawk Eagle, the monkey-eating Crowned Eagle and the Bateleur. The Karura and Langata Forests are also notable for their butterflies, especially during the first two months of the year. Seven or eight species of swallowtails may be seen at a time and many kinds of *Charaxes*, including the black and blue *Charaxes nandina*, can be observed flying around the treetops.

North from Nairobi the nearest bird haunt is Sukari dam, a favored locality for Allen's Gallinule, the Purple Gallinule and others of the rail family. A few miles further along the road, at Thika, the Chania and Athi Rivers flow close together, and the Chania drops away in the dramatic Blue Post Falls. For the botanist a rare and beautiful white-and-lilac vanilla orchid grows in the riverine forest below the Falls. Here the Mountain Wagtail occurs along the rapids and Peters' Finfoot inhabits the overhung, more sluggish stretches of the rivers. Within a few miles the Athi puts on its own show at Fourteen Falls, also a good finfoot locality, where at least one pair of Banded Harrier Eagles make their home and several pairs of Hadada Ibis nest. Rising abruptly from the surrounding relatively flat coun-

try is forested Doiyo Sabuk, an isolated mountain maintained as a sanctuary by the National Parks authorities. In its Albizzia forest and wooded gorges several interesting and uncommon birds of prey may be encountered — Ayres' Hawk Eagle, the African Harrier Hawk and the Black Sparrow Hawk. On the summit a depression favors the growth of a sea of orange *Leonotis*, a great attraction to sunbirds — but care must be taken not to annoy the pair of rhinoceroses which use the adjacent mud wallow.

Some twenty miles along the Garissa road from Thika lies the thorn-bush and savannah of the Yatta Plateau. In the swamps off the Yatta furrow may be seen the beautiful Yellow-crowned Bishop, jet black with a pure yellow crown and rump which in display the male puffs out until he appears twice his normal size. Another attractive seed-eater occurring in this area is the very local Gray-capped Silverbill.

South of Nairobi a "must" for all birders is Lake Magadi, a brackish lake famous for its water-birds. The road descends in steps down the eastern wall of the Rift Valley, from an altitude of over 7,000 feet on the Ngong Hills to 2,000 feet at Lake Magadi. As the altitude changes so do the birds. I recollect a trip I made to Magadi and the northern end of Lake Natron in 1957, when I had the pleasure of introducing Roger Tory Peterson to this part of the world. During the weekend we listed over two hundred species seen at close quarters. Of special interest at the lake is the small Chestnut-banded Plover, often called the Magadi Plover, a species smaller than a Semipalmated Plover, with a narrow chestnut band across the chest. Many interesting animals may be encountered along the Nairobi-



Ornithologist John Williams of the Coryndon Museum, who will be in charge of the "Bird Watchers' Safari," in Cherengani Mts.

Photo by G. Lucas

Magadi road, including Gerenuk during the day and Caracal and Aard-wolf from dusk onwards.

To the east of Nairobi on the extensive Athi and Kapiti plains many open country birds make their home, notably the scarce Hartlaub's Bustard. The male has a remarkable display, flying straight up into the air, then dropping to earth like a pricked balloon. Such rare larks as the Athi Short-toed Lark and the long-billed Kenya Short-tailed Lark also occur on these plains, alongside the largest of all our birds, the Masai Ostrich. Further afield the Muchakos-Makueni area is a good locale for Wahlberg's Eagle. On the European dairy farms around Ulu can be found the Violet-crested Touraco and two fine Bush Shrikes, the Sulphur-breasted and the Gray-headed.

The roads westward from Nairobi lead to a wealth of bird localities. The high level rain forest of Katamayo and the Katamayo river offer good trout fishing, elephants, black and white colobus monkeys, tree ferns and orchids, and birds

such as Crimson-wings, Bar-tailed Trogons, Star-spotted Bush Robins and Brown-capped Weavers. The subalpine plateau of the South Kinangop, over 8,000 feet up at the base of the Aberdares, has many special birds. Outstanding is the long-tailed Delamere's Whydah, perhaps the most exciting African bird to see for the first time. On the mountain streams at the edge of the forest are Black River Ducks, Giant Kingfishers and Mountain Wagtails. In forest glades and where suitable flowers are in blossom, the vivid Kenya Double-collared, Tacazze, Malachite and gorgeous Golden-winged Sunbirds occur in profusion. Rather further afield is the Aberdare Mts. Royal National Park, with its approach drive through mountain forest and bamboo where the fine Jackson's Francolin and the Scaly Francolin are common and fearless. The road ascends into the grandeur of the alpine zone with its many exquisite mountain flowers and interesting birds like the Mountain Chat, Shelley's Francolin and Slender-billed Chestnut-wing Starling. The starling often nests below waterfalls in the manner of a European Dipper.

At a lower altitude, about 6,000 feet, one can visit any of the three nearby lakes in the Rift Valley: freshwater Lake Naivasha with its famous population of African Great-crested Grebes and a multitude of other waterfowl; or the two brackish lakes Elmenteita and Nakuru. At the former the Greater Flamingos breed spasmodically on tiny islands on the southern side of the lake, islets also used as nesting places by Gray-headed Gulls and the Sacred Ibis. On Nakuru lake, when conditions are favorable, there can be what Roger Peterson has called the greatest bird spectacle in the world — the great concentration of Lesser Flamingos, a million or more strong.

Adjacent to Lake Naivasha is Hell's Gate, a series of inland cliffs and gorges which boast a pair of resident Lammergeiers, Verreaux's Eagles, Egyptian Vultures and a colony of Ruppell's Griffon Vultures. At the base of the cliffs I have often seen Klipspringers and pairs of Hildebrandt's Francolin.

In its immature plumage, the head and neck of the Sacred Ibis are covered with feathers. It is only when it attains the adult stage that these parts are — less attractively — bare.

Photo by Harry Williams

ANIMAL KINGDOM



It is not possible in this short article to mention more than a very few out of the many wonderful birding localities in East Africa. Let me end with some recent memories which may serve to convey a picture of our avifauna:

One of my most vivid recollections is of dawn on Lake Kyoga in a dugout canoe. Mist hung over the water and as we paddled softly through the lily-covered lagoons, packs of pygmy geese rose on all sides and long-toed lapwings and jacanas voiced their resentment at our invasion of their retreat. On rounding an out-jutting islet of papyrus I experienced the thrill of seeing that prehistoric-looking bird, the Whale-headed Stork, standing motionless less than ten yards away.

I recollect a late afternoon visit in April to the



sandbars and mudflats of Mida Creek on the Kenya coast. Concentrated by the rising tide into an area of less than an acre was an assembly of northern-breeding waders the like of which I have never seen before or since. Red-plumaged Curlew Sandpipers in their thousands, equal numbers of Little Stints, and flocks of summer-plumaged Great Sand, Mongolian, Black-bellied and Arctic Ringed Plovers mingled with parties of Terek Sandpipers, Greenshanks, Sanderlings, Curlews and Whimbrels.

In northern Turkana, in semi-desert bush country fantastically rich in bird life, I often saw the brilliant Carmine Bee-Eaters using Kori Bustards as animated perches. As the bustards stalked through the long grass, their passage disturbed in-



Big birds of prey nest in the forests of Kenya. This is the great Bateleur Eagle, perched on a dead branch above its nest.

Photo by G. Lucas

The Hammerhead Stork builds the largest nest of any bird in Africa — an enormous structure of sticks, able to support a man.

Photo by Harry Williams

sects which the bee-eaters flew out to catch, returning to kill and eat their prey on the bustard's backs. The bustards paid no heed at all to their uninvited passengers.

Another Turkana memory comes from Lake Rudolf. In the warm shallows of Ferguson's Gulf on the western shore I have watched migrating Marsh Sandpipers in flocks of hundreds, and the constant passing overhead of springs of Garganey. It was somehow incongruous to see these northern birds in close association with flocks of feeding African Skimmers, Pink-backed Pelicans and Lesser Flamingos.

Such are the memories — and there are hundreds like them — stored up by a bird watcher in East Africa.



Rubber, Tin—and Rhinos

By OLIVER MILTON

Southeast Asia Conservation Expedition

The author of this brief article will be remembered as the person through whom the Zoological Society received a young Takin from northern Burma in 1959. At that time Mr. Milton was engaged in the Burma Wildlife Survey. He has now moved into Malaysia on his Southeast Asia Conservation Expedition, sponsored by the Zoological Society.

KUALA LUMPUR, the capital of the Federation of Malaya, is a modern bustling city surrounded by rubber plantations and tin mines. It is the hub of a network of some of the finest roads in Southeast Asia and if one travels along the highway leading north it would seem unlikely that the surrounding country harbors much wildlife. This is a legitimate conclusion because the traveller sees only miles and

miles of rubber trees (sprayed with deadly sodium arsenite which frequently causes the death of domestic and wild animals) and vast expanses that have been denuded of all vegetation by the great dredges searching for tin, the "black gold" of the region. However, at the 72nd mile there is a road leading to the west and if you follow it for a few miles you come to a canal. Two miles down the canal by boat brings one to a spot that

seems to be in the middle of nowhere because in all directions the dense dark green jungle wall hides a gigantic swamp forest. This vicinity, less than three hours from Kuala Lumpur, is the habitat of the Sumatran Rhinoceros, one of the world's endangered species of animals.

There are two species of rhino in Southeast Asia — *Rhinoceros sumatrensis* and *R. sondaicus*. The former is commoner and smaller than the latter which, except for a small concentration of about 50 animals in the Ujung Kulon Reserve at the western tip of Java, is not known to exist for certainty elsewhere in Southeast Asia. Still, during my work in Tenasserim, Southern Burma,

The Sumatran Rhinoceros is one of the rare and threatened animals in the world today. This one is in the Copenhagen Zoo.

Photo by Erik Parbst

Within three hours' travel from Kuala Lumpur is a great swamp, surrounded by thick forest. Here lives the Sumatran Rhinoceros.

Photo by Oliver Milton

in 1960, I heard reports that there *might* be some in the remote jungle on the Burma-Thailand border east of Tavoy. In Malaya the last definite record of *sondaicus* was in 1937 when a specimen was shot in the Ulu Bernam area, slightly north of the area I now write about.

In 1953 the Drainage and Irrigation Department (D.I.D.) of Selangor State commenced work on the canal to supply water for a coastal agricultural project. During the following years the laborers saw rhinoceroses on numerous occasions. I have spoken with some of these persons and they say that there are four animals: one large, two medium-sized and one young. Each is said to have but a single horn. (The Sumatran Rhinoceros has two horns and usually the posterior one is very small and often hard to see. The *sondaicus* has only one horn). One night a rhino came into a camp and licked the salt from an old shirt that had been thrown away. In March, 1957, and again in August, 1960, a solitary rhino was seen and photographed on the Lima Blas oil palm estate about five miles from



the canal. This animal was identified as *sumatrensis*.

I hoped to find out more about the rhinoceros population and suggest plans for their future preservation. The Director of the D.I.D. gave me full cooperation and lent his departmental bungalow at the north end of the canal to act as a base camp for a period of two months. The area in which I was interested lay about two miles south of this bungalow. To the west and south of it spreads a vast expanse of swamp forest. To the east is the Bukit Belata Forest Reserve and the northern part is bounded by blocks of forest in which commercial extraction of timber is taking place. Slightly further to the northeast is a new land settlement scheme where more than 600 Malay families will settle on about 9,000 acres. The rhinoceroses are therefore living on a kind of island bounded by swamp and human beings.

The land is about 50 feet above sea level, al-

though to the east there is a hill that rises to 829 feet. The lower land is almost entirely swamp forest characterized by such trees as *Koompassia malaccensis*, *Shorea rugosa uliginosa* and palms such as *Licuala* spp. and *Cyrtostachys lakka*. A river, the Sungei Dusun, had been dammed so that its water flows into the canal. This has resulted in many acres of forest being flooded and the trees have subsequently died. The higher portion of the ground is poorly covered with a non-dipterocarp type of forest which is typified by trees of the families Burseraceae, Sapotaceae and Dilleniaceae. The canopy is fairly open, there are few large trees and much of the undergrowth consists of the Bertam palm (*Eugeissona triste* Griff.) and rattan (*Calamus* spp.). The largest trees are probably the "Jelutong" (*Dyera costulata*) and there is a network of paths connecting these which has been made by the Chinese and aborigine tappers who collect the latex for eventual use in chewing gum. These paths are also used by the rhinoceros and elephant.

I was very lucky in seeing one rhino but unlucky in missing the same or others on several later occasions. One morning I had stopped for a short rest when a noise attracted my attention to the left. In a matter of seconds a rhino ambled out of some thickets and walked towards me on the path. Unfortunately it was almost entirely hidden by Bertam palm. It stopped abruptly and stood for a few seconds facing me. After a snort it turned about and trotted off into a patch of dense undergrowth. Although it was only 16 paces from me I was unable to identify the species but I could see that it stood at least 4' 6" at the shoulders. After this brief encounter I continued to see fresh tracks in various parts of the jungle and, in particular, at a wallow. I had cleared an overgrown path to reach this mud puddle and having visited it in vain for eight consecutive days I approached from another direction, rather casually, on the ninth day. I had to do a little path clearing and when only 20 yards from the wallow there was a splashing and general commotion, followed by the sound of break-

A rude shelter of sticks and leaves, sufficient to keep off the rain, was built near a fallen tree 20 yards from a wallow. The animal continued to make visits, unafraid of the structure.

Photo by Oliver Milton



A relaxed moment in the life of the Sumatran Rhinoceros in the Copenhagen Zoo — and a good view of the big cushioned feet.
Photo by Erik Parbst



ing branches. The time was 11 a.m. and the rhino had been disturbed. The animal had been lying at the side of the wallow and then crashed off into the dense swampy area a few yards away. It returned the next day and continued to do so for a week after which I did not see any signs of it again. Unfortunately there was no suitable tree in which to construct a platform. There was, however, a fallen tree about three feet in diameter and 20 yards from the wallow, in full view. As it was next to the path used by the rhino I hesitated to build a ground level platform for fear of scaring the animal but I finally decided to put up a rude shelter. The animal paid little attention to it. I rigged up a trip line for flash-light photography but met with no success.

I made plaster of Paris casts of four clear tracks. Taking into account the nature of the ground, there is reason to believe that they were made by at least two and possibly by three animals. The measurements of the tracks are as follows:

	Length (from tip of central nail to rear of pad)	Breadth (between tips of lateral nails)	Central nail
Cast 1	21 cm.	22 cm.	8 cm.
2	20 cm.	19 cm.	6 cm.
	(possibly same animal)		
3	19 cm.	18.5 cm.	6 cm.
	(possibly hind foot)		
4	15 cm.	14 cm.	5 cm.

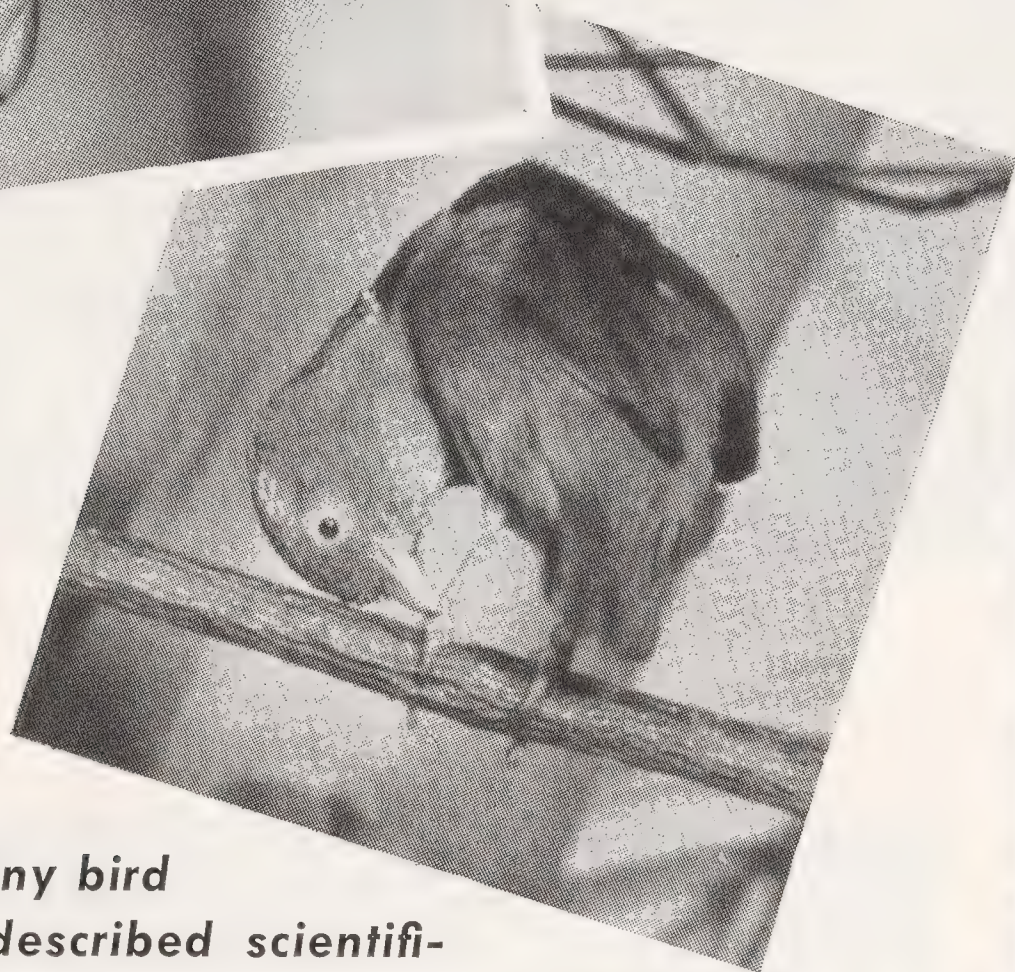
Summarizing the information available, we

know that in 1937 a *sondaicus* was shot in this vicinity, which is a typical habitat, i.e., low swampy ground. This species is also known to travel to higher levels periodically. The *sumatrensis* is more apt to be found in the hills near the sources of streams and yet it has been seen on several occasions in this low-lying area (e.g., Lima Blas estate). Among the many small trees about three inches in diameter that grow along the paths followed by the rhino and are used as rubbing posts, is one that I measured. Dried mud and absence of bark reached to a height of 4' 2" above the rhino's tracks. If this were caused by rubbing with the shoulder, then the height of the animal at the shoulder would be about 4' 10". This would be too big for a *sumatrensis*, but the marks could have been made with the head.

I have submitted recommendations that this small area (about 19 square miles) be made a game reserve especially for the rhinoceros. At the time of writing this article there has not yet been any official declaration, although it is fairly certain to be approved.

* * *

(By later mail.) The first week in February I paid another visit to the area and found distinct tracks of three separate animals, including one youngster. One of the laborers also told me that three had been seen together and so we now know for certain that at least three rhinoceroses are living within a comparatively short distance of Kuala Lumpur.



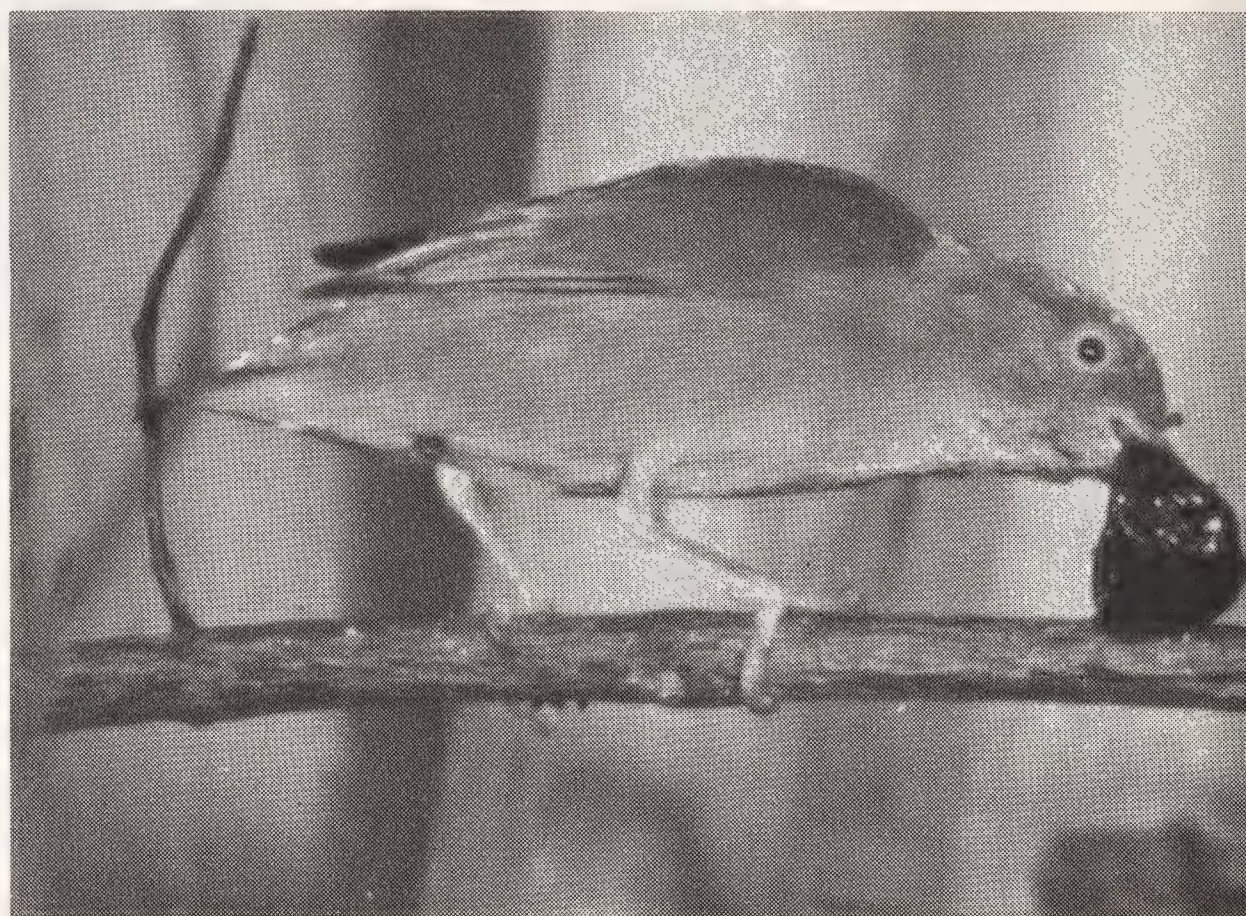
This tiny bird was described scientifically in 1861, but not until January of this year was it seen alive in any zoological garden. Then two specimens were presented to us.

After 101 Years—

A Yellow-billed Chlorophonia

By WILLIAM G. CONWAY

Director & Curator of Birds



IN 1861 A FAMOUS ORNITHOLOGIST, Philip Lutley Sclater, turned the skin of a tiny green bird over and over in his hand. Choosing words carefully (we may be sure), he wrote, in a characteristically terse four Latin lines, a description of the first and last Yellow-billed Chlorophonia ever to puzzle a scientist's eyes — until January 1962:

6. CHLOROPHONIA FLAVIROSTRIS

Psittaceo-viridis, remigibus alarum et rectricibus intus nigricantibus, illarum pogonis externis caerulescenti-viribus: subtus paulo dilutior, ventre medio et crisso flavis: rostro et pedibus flavis.

This formal paragraph, which appeared in the 1861 *Proceedings of the Zoological Society of London*, announced the discovery of the "new" species, described it, and named it. Sclater noted further, in English, that the new bird differed from other chlorophonias in having yellow legs, a yellow bill, and no blue in its plumage. He thought his single skin might be that of a female

because it had no blue, and noted that it was from somewhere in Ecuador, perhaps "from the eastern slope of the Andes."

Now, a hundred years later, *Chlorophonia flavirostris* may be seen alive in the Jewel Room in our Main Bird House.

Chlorophonias are a small group of green tanagers, only four species and ten races, found all the way from southern Mexico to northern Argentina. Like most of the 193 other species of tanagers, they have been little studied, but those chlorophonias that ornithologists have watched are known to make curious domed nests with side entrances. *Chlorophonia flavirostris* probably does the same. No one yet knows the facts of chlorophonia courtship, and no good explanation for the curious divergence of this small but widespread group of little green tanagers has been advanced. Sclater's lonely bird skin has rested uneasily in its tray at the British Museum for a very long time, for a single testament to the existence of a whole bird species is not only an object of ornithological

fascination, but also a subject of taxonomic suspicion.

Our bird has helped to certify the Yellow-billed Chlorophonia's registry. It is one of two presented to us on January 12 by Edward Marshall Boehm, a Patron of the Society. Presenting rare specimens that are new to our collection is not a novel experience for Mr. Boehm, for though our collection has exhibited far more species than any other bird exhibit in America, in the past three years he has donated from his own remarkable private collection more than 40 species new to us! Mr. Boehm's personal collection, which he uses as models for his famous bird porcelains, is probably the largest private collection of small birds in the world.

Shortly after the two tiny chlorophonias (half the size of an English Sparrow) reached the Zoo, one showed signs of illness, especially respiratory distress. Laboratory tests proved inconclusive,

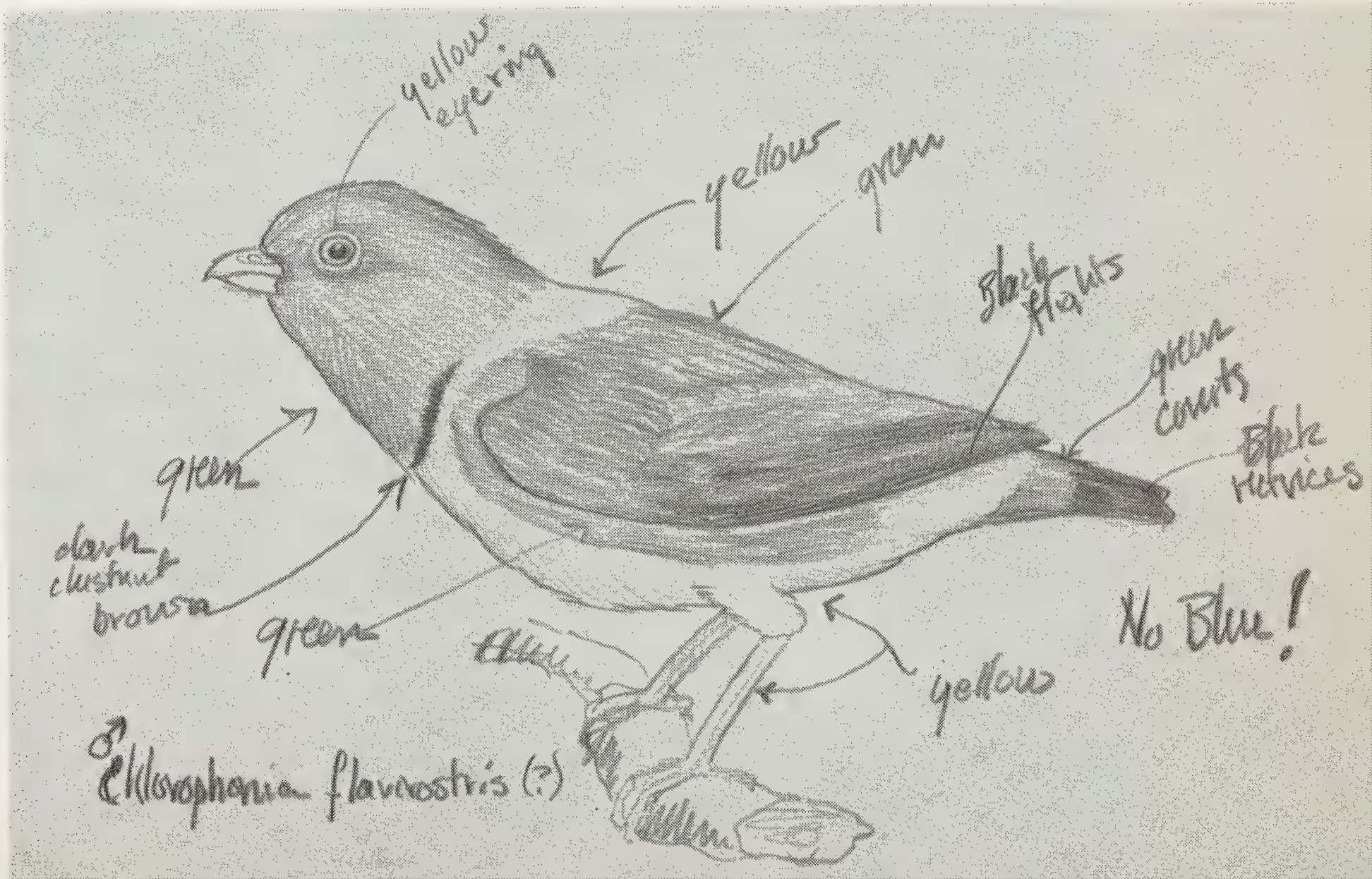
and broad-spectrum antibiotics were of no avail. A post-mortem examination did not pin down the cause of the bird's death, but did reveal that despite its simple green plumage, matching Sclater's description, it had been a male and in breeding condition.

But then, on March 21, a visit to Mr. Boehm's collection revealed the greatest surprise of all. With justifiable pride, Mr. Boehm showed us what is, apparently, the first *adult* male Yellow-billed Chlorophonia ever seen. While sexually mature, our bird must not have been in adult plumage. Mr. Boehm's adult male agrees with Sclater's description in its yellow bill and legs and its yellow eye ring, but there the resemblance ends, for the parrot-green plumage is broken by a mantle of golden yellow — a color which encircles the bird's neck and covers its breast, abdomen and rump, leaving only its head, wings, sides and flanks and a few under and upper tail coverts green. Two curious brown crescents border the ventral sides of the bird's throat where its green hood meets its yellow breast. There is no blue in the plumage. We sketched the bird and the drawing is reproduced below. But there is still a nagging doubt in our minds — it is barely possible that this bird is a new form (*Chlorophonia flavirostris boehmi*, of course!). It appears larger than our specimen.

Why the long wait between chlorophonias? Apparently *flavirostris* lives in a very isolated area — perhaps it is restricted to a single mountain valley where long ago a small population became isolated from its relatives. Now, some native bird collector has found this area. At all events, we may be sure of one thing; the Yellow-billed Chlorophonia is an authentic bird rarity.



Above — Our Chlorophonia photographed in flight at a speed of 1/12,000 of a second. At the right is a field sketch made by Mr. Conway from the bird — possibly a new form — in Mr. Boehm's aviary.



News from the Conservation Foundation

Historical Study of Maine River and Bay Fisheries

A historical study of Maine river and bay fisheries has been initiated within the past few weeks and is to be conducted by Dr. James A. Storer, Professor of Economics and head of the Center for Economic Research at Bowdoin College, in collaboration with Dr. James Wilson, Department of Political Science at Bowdoin. Dr. W. Harry Everhart, Chief of Fishery Research and Management of the Atlantic Sea-Run Salmon Commission at the University of Maine, will act as consultant for the study. The purpose is primarily to evaluate the economic and employment losses to the state and local communities bordering the Kennebec and Penobscot Rivers, due to the loss of a natural resource because of water pollution. The study will also assess the loss of revenue and employment in the coastal areas as a result of pollution which has closed down some 60,000 acres of clam flats.

Scientific Advisors Meet

Among those attending a special meeting of the Conservation Foundation's Scientific Advisory Council on March 30 were Robert C. Cook, Population Reference Bureau; Harold J. Coolidge, National Research Council; Edward H. Graham, Soil Conservation Service; Starker Leopold, University of California; Carl O. Sauer, University of California; Stanley A. Cain, University of Michigan; and Abel Wolman of Johns Hopkins University. The group considered long-range needs in research and education and helped plan the forward progress of the Foundation for the years ahead.

Educational Activities

Martha Munzer, education assistant, recently attended the 16th annual convention of the National Association of Soil Conservation Districts in Philadelphia, where she addressed the Education Committee on "New Approaches for Con-

servation Education." As a Director of the Conservation Education Association, she also attended a meeting in which plans were made for the coming annual summer conference of the CEA to be held in Stevens Point, Wisconsin. The theme of the forthcoming conference will be "Today's Conservation Priorities: How Can Conservation Education Meet the Challenge of Urbanization?"

Mrs. Munzer's new book, *Unusual Careers*, which explores job opportunities for young people in the fields of Conservation, Oceanography, Solar Energy Research and City Planning, will be published by A. A. Knopf in April.

Briefly Noted

Dr. Frank Darling and Roger Hale attended the North American Wildlife Conference in Denver, March 12 to 15, where Mr. Hale delivered a paper on conservation education at the graduate level . . . Noel Eichhorn, who recently received his master's degree in Natural Resources from Oregon State University, has become a research assistant . . . Stephen Blodgett presented our Report on Recreation Development of the Allagash Region of Maine at a meeting called by the Natural Resources Council of Maine at Colby College, Waterville, in February . . . Recommendations made in Dr. William Brown's case study of four pesticide programs are being studied by agencies of Federal and State governments in planning pest control operations for 1962 . . . For the fourth year, the Audio-Visual Department will serve both as a prescreening committee and as final judges for the American Film Festival, to be held on April 25, 26, 27 . . . Dr. Elizabeth Hone, who directs the Foundation's Conservation Curriculum Center in California, has received an award from the California Conservation Council for her "long-continued effort and devotion, in line of duty, in the cause of conservation education" . . . The symposium of essays on population pressures, now titled *Our Crowded Planet*, will be published early this summer by Doubleday & Company.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Society's Office Moves

As of mid-February, the office of the Zoological Society is at 630 Fifth Avenue, New York 20, N. Y. This will be the headquarters of Dr. Fairfield Osborn, President, and G. W. Merck, Secretary. Previously the Society shared quarters with the Conservation Foundation at 30 East 40th Street, still occupied by the Foundation.

Spring Openings

Spring opening date for the Farm-in-the-Zoo is April 7 and for the Children's Zoo April 14. In the past the Children's Zoo has always opened on the Saturday before Easter, but the date was advanced this year because of the lateness of Easter. Other facilities, including several restaurants which were closed for the winter, and Tractor Trains, began operating in March.

High Census at the Zoo

The end-of-the-year census of species and specimens in the Zoological Park revealed a total of 1,107 species and 2,887 specimens. This is the largest number of species we have exhibited since 1917. Details of the census are:

	<i>Species</i>	<i>Specimens</i>
Mammals	198	574
Birds	640	1,571
Reptiles	269	742

A census on December 31 does not, however, show the real strength of the collection, for mid-winter is generally a low point. The reptile and bird collections, particularly, build up during the summer and the total may rise by fifty or more species.

IN BRIEF

Lion Family. The first really warm spring days will see our Lion family romping together on Lion Island in the African Plains. The young pair exhibited on the Island last year produced two cubs on January 29, which have been kept indoors during the winter. The cubs and their

mother will be accustomed to the limits of the Island gradually, in the hope that the cubs will not recklessly jump into the moat.

Bone-breakers. Two of the giant eagle-vultures variously known as Lammergeiers, Bearded Vultures or Bone-breakers, will go on exhibition this spring. They are the white-breasted form found deep in Asia and were acquired for us by a dealer through a European Zoo with trading connections behind the Iron or Bamboo Curtains. The Lammergeier is called "Bone-breaker" from its habit of carrying large bones to great heights and dropping them so as to crack and expose the marrow, and it has been unjustly charged with carrying off sheep and even children. Actually it is capable of taking small lambs or baby antelopes. The bird has an 8-foot wingspread and the 1921 Mt. Everest Expedition observed it soaring at 25,000 feet.

The Case of the Salty Feathers. James's Flamingos have a high salt requirement, and it is known that under distress conditions they extrude salt from their beaks. Director Conway remembered this recently when, watching our flock of James's, he noticed that the breast feathers of three birds were quite wet. These were the three lowest in the peck order among the James's — dominated by all the others. To test this theory, he caught a bird, plucked a wet feather and tasted it; it was salty. The three birds were taken out of the flock immediately and segregated, so that the pressure was off. Their salt-dribbling stopped within an hour.

Big Whales, Little Fish. The Aquarium has been experimenting with keeping Codfish, Atlantic Salmon and Sturgeon in the Oceanic Tank with its White Whales, or Belugas. The Belugas have occasionally shown what seems to be curiosity toward their new tankmates, but have not molested them.

\$8,800 Grant. The Society has received a grant of \$8,800 from the National Science Foundation

to support the investigations of Dr. Klaus D. Kallman, the Aquarium's Research Associate in Genetics. Dr. Kallman is studying the genetics and evolution of the Amazon Molly, a peculiar fish from Texas and Mexico, that exists only as females.

PUBLICATIONS OF INTEREST

AMPHIBIANS AND THEIR WAYS. By H. Rucker Smyth. xv + 292 pp., illustrated. Macmillan Company, New York, 1962. \$6.50.

This well-organized and well-written introduction to

the habits and natural history of salamanders, frogs and toads will be a pleasant surprise to mature herpetologists and a beginning for the younger generation. Written by a "Connecticut housewife" who has a vivid interest in and a broad understanding of amphibian life, it presents a clear, non-technical account of these animals that ranges from eggs to economics. Apparently aimed at about high-school level, it can be read with profit by anyone who has an interest in these interesting but little appreciated animals. — H. G. D.

THE TIGERS OF COMO ZOO. Written and illustrated by Edythe Records Warner. 93 pp. Viking, New York, 1961. \$2.50.

A pleasant and sympathetic account, for children, of the rearing of Siberian Tiger cubs in the Como Zoo in St. Paul, Minn.

New Members of the New York Zoological Society

(Between January 1 and February 28, 1962)

Benefactor

Royal Little
Howard Phipps, Jr.

Founder in Perpetuity

Mrs. Cordelia S. May

Founder

Alexander Aldrich
James Walter Carter
George W. Merck, Jr.
Alfred Gwynne Vanderbilt

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Peter Daniel Geffen
Peter F. F. Kissel
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Lester A. Barrer
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Mrs. Lillian Blickman
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HAVE YOU ALWAYS WANTED TO SEE AFRICA?

Now you can do it—under the best possible auspices

The New York Zoological Society is sponsoring a Safari to East Africa, leaving New York on June 7. An "animal tour," of course; birds and mammals and an unforgettable experience await you.

The party is limited to Members of the Zoological Society, and limited in numbers. It will be conducted by a naturalist who knows Africa—lives in Africa—to whom the wild life of Kenya and Tanganyika and Uganda has few secrets.

Sample his knowledge and the almost unbelievable wealth of bird life in his article beginning on page 50 of this magazine. John Williams is the Ornithologist of the Coryndon Museum in Nairobi—experienced, wise in the ways of the wild.

If you *have* always wanted to see Africa—
do it now!

For details, write to:

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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Are Animals People?

DYED-IN-THE-WOOL zoologists are apt to rebel when human characteristics are attributed to animals. This, as we know, is frequently done in popular articles concerning animal life where it is implied that the actions of animals are motivated by the same impulses as those of people. In the stern lexicon of the zoologist, this is known as anthropomorphic interpretation of an animal's behavior. Yet the position taken by the zoologist in this matter, if too fixed, is also open to question. Certainly it is not right to take an extreme attitude on either side of the case. The fact is that people and animals, or, we should say, many animals, share a host of common characteristics and motivations — fear, devotion to family, playfulness, mimicry, deception, living in herds or living alone, loyalty to the group, common "languages," and many other qualities.

If animals were capable of a plebescite they might be as reluctant to have themselves compared to people as vice-versa and, we might grant, with some reason. Of course people are animals, but that is a biological observation. In any case, affinities are involved, which perhaps it would be as well not to attempt to define too literally.

Fairfield Osborn

SMITHSONIAN
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First Project: The Polar Bay

By WILLIAM BRIDGES

Curator of Publications

THE FIRST PROJECT of the Zoological Society's Development Program has been completed. On May 10 we opened the Polar Bay exhibit at the Aquarium as the new home of our Walruses and various species of Seal. It was an instant and complete success, not only with the public but with the animals who share its clear and cold and deep waters.

Polar Bay, so called because it was designed for the exhibition of marine mammals from sub-Arctic oceans, was initiated last year by the gift of \$25,000 by Alva B. and Bernard F. Gimbel.

It was completed, at a total cost of \$180,000, by funds contributed to the Society's Development Program. Considerably expanded from its original concept, it now takes its place as a significant addition to the Aquarium's attractions.

Polar Bay is big — 120 feet long and 80 feet wide — and consists essentially of two pools, one 70 feet long and 40 feet wide with water 8 feet deep. This pool has been assigned to big Olaf and the three Gray Seals and has a 40-foot series of underwater windows for viewing the animals below the surface.

Adjoining the big pool but separated from it by a steel gate is a circular pool 30 feet in diameter with 6½ feet of water. Here we can exhibit plump and affectionate Ookie, the Pacific Walrus, and her two inseparable Walrus companions, little Seeku and Tipuk. Haul-outs, a shift area, an isolation tank and a filter house complete the installation.

The pools will hold approximately 135,000 gallons of seawater drawn from deep wells on the Aquarium's grounds and recirculated through a special filter system that operates at a thousand gallons a minute. We consider our water supply as ideal, for it maintains a temperature of about

53° F. throughout the year and thus keeps the animals cool in summer and warm in winter.

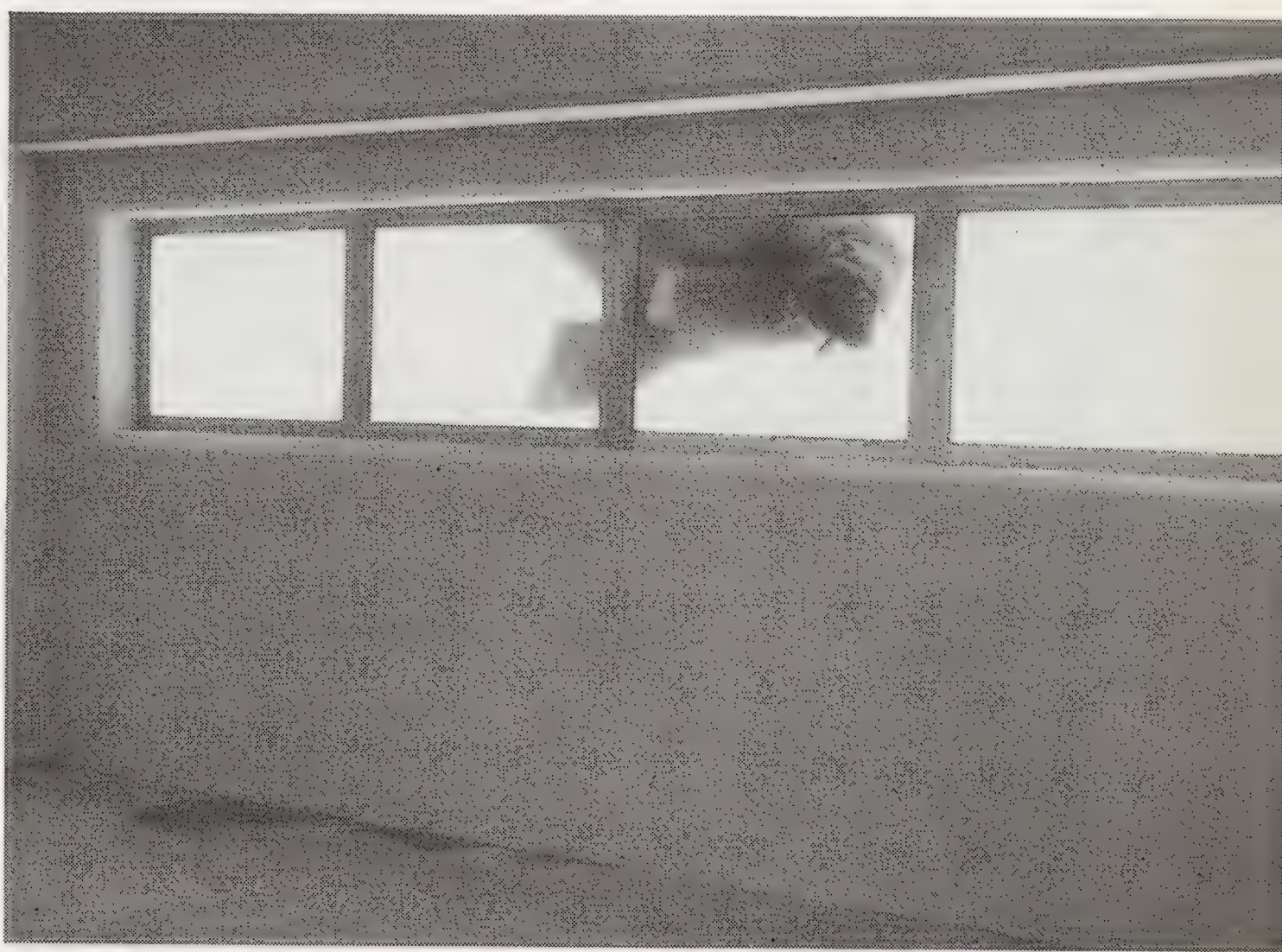
The four Walruses and three Gray Seals were moved to their new home on the evening of May 9 from the Tripool exhibit 150 feet away. The job consumed two trying and at times tense hours but had been thought out so carefully by Director Coates and Associate Curator Ray that there were no "incidents."

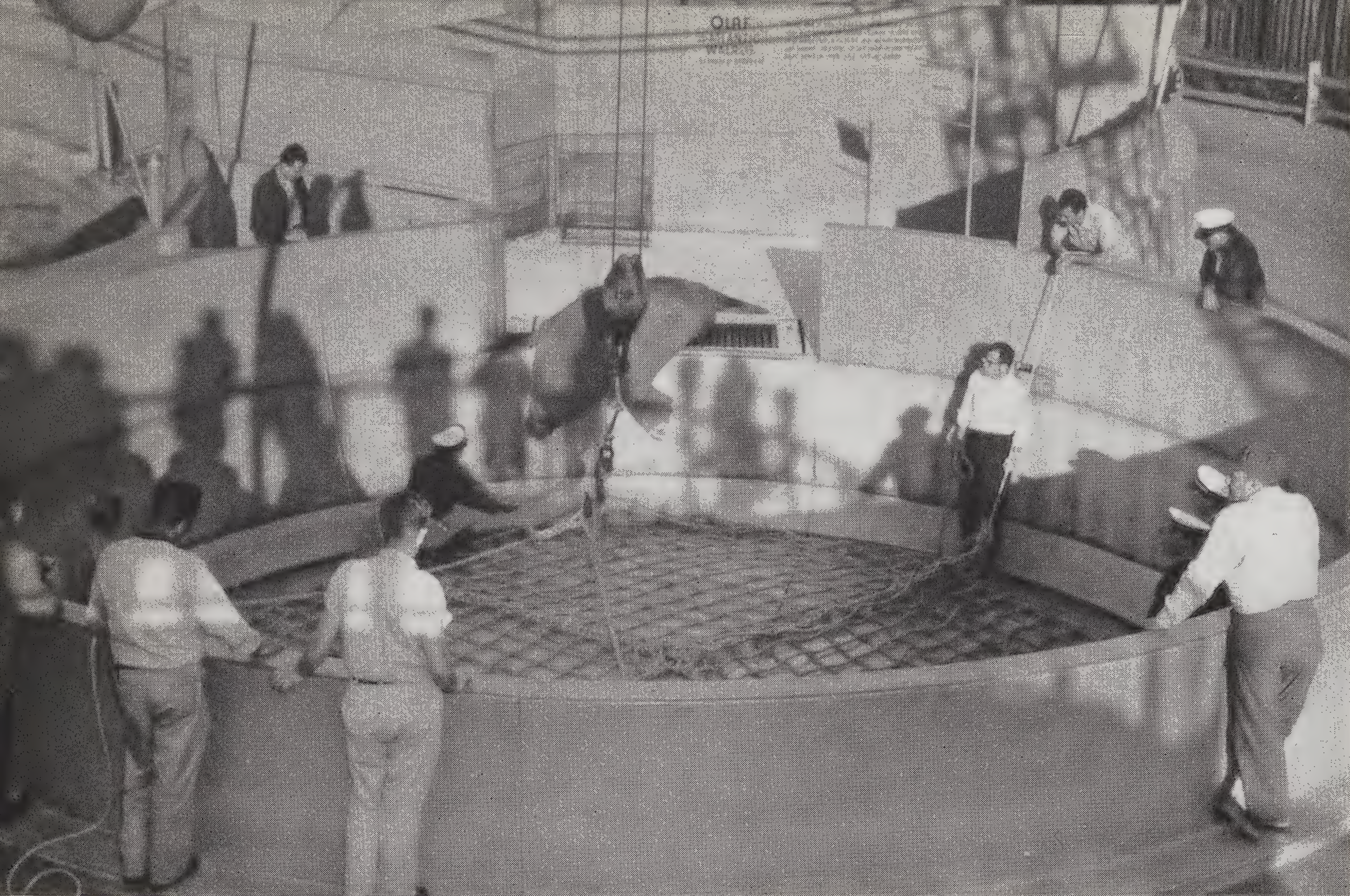
Olaf was the big problem. His weight had been estimated at around 1,700 pounds and while the Aquarium staff thought he *might* be cooperative enough to walk from the Tripool to his new home, the possibility had to be considered that he

Olaf behaved beautifully at the official opening of Polar Bay — curious about his visitors, he allowed Mr. Gimbel to touch his whiskers as Dr. Osborn watched.

Photos by Marjorie Castora

Below — A general view of Polar Bay. A stairway at the extreme right leads to a series of underwater windows. Right — This is a typical swirling pose of Olaf when he cruises around the Bay.





Above — A cargo net was spread on the floor of the Tripool and time after time Olaf ventured this far down, and then drew himself back. Right — After 45 minutes, up he went.

would go exploring instead. Last year, when he was moved from the Oceanic Tank to the Tripool, he was induced to enter a big box which was lifted up by a crane and carried to the Tripool. But now he had obviously outgrown the box, and building a new one would be expensive.

The solution hit upon was to spread a heavy rope cargo net on the bottom of his drained pool, bait him with food into the middle of the net, and then to hoist net and all by a crane.

It worked, but it took 45 minutes to make it work. Olaf lay on the haul-out of his pool while the net was being positioned, watching everything. Finally handfuls of fish and clams were offered him by Tankman Ponciano, standing on the bottom of the pool. Olaf stretched to take the food and time after time it seemed that more than half his enormous body was extended out and down and he must inevitably slide the rest of the way. Then when he attained a mouthful of food he simply oozed back up on the haul-out.





Once he did descend, but disarranged the net in doing so, and while it was being spread again he climbed back to the haul-out.

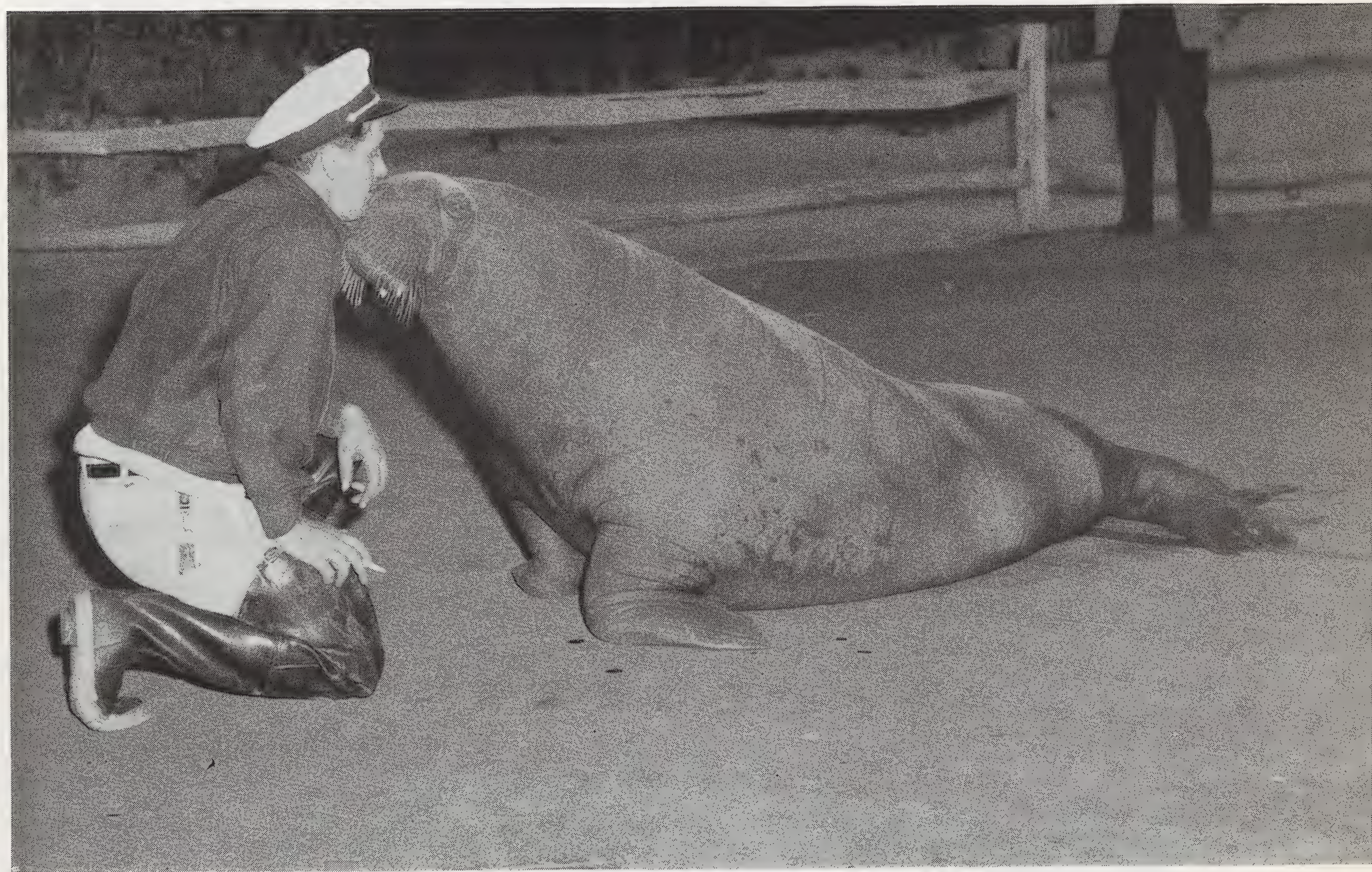
But all things end, and at 7:11 p.m. Olaf was in position in the center of the net and the crane hoisted him. It had been feared that he might struggle, but he lay perfectly still from the instant he felt himself off the ground.

By means of a weighing device between the boom and the net, Dr. Ray determined Olaf's weight to be 1,880 pounds. He is by far the largest Walrus in captivity — and still a growing "teen-ager."

A few minutes later the boom lowered Olaf into the Polar Bay and moments later he was taking fish from Tankman Young's hands.

And Ookie, the Aquarium's pet? She *walked* the whole way, like the Walrus lady she is.

Left — A few minutes later the crane, with its 60-foot boom, gently lowered Olaf into Polar Bay. Below — Encouraged by tankman Young, her friend, Ookie waddled to her new home.



Albatrosses of the Sub-Antarctic

By JOHN WARHAM

MAN'S ADMIRATION of the albatross for its perfection in flight, for its ability to survive in a storm-tossed wilderness far from land, is often tinged with envy. Even in an age of rockets and vertical take-off planes we have a good way to go before we can equal the mastery of the air gained through evolution over vast ages by these great birds of the sea. This was brought home to me not long ago at an island in the sub-Antarctic when I saw how the winds that grounded all our helicopters merely helped the resident albatrosses to sail along with added ease and grace, and in perfect safety.

The fact is that the westerly winds of the "Roaring Forties" are essential to the way of life of the southern albatross. Without being able to take advantage of the varying air speeds between the waves and the sky, sustained flight would be impossible and on the infrequent calm days when the birds must beat their wings to remain airborne, they evidently tire quickly and soon settle to rest upon the sea.

Nine of the 13 albatrosses have their homes in the southern oceans. These birds may be divided into three groups. There are the giant albatrosses, in the genus *Diomedea*, with wing spans of about 10 feet. Breeding members of this group have black and white upperwings and mainly white bodies. The second group contains the "mollymawks," as the whalers call them. These birds are also placed in the genus *Diomedea* but they are medium sized albatrosses with wing spans of about 7½ feet. They have white bodies and the dark of their upperwings is continued across their backs as dark bands. Lastly there are the two Sooty Albatrosses (*Phoebastria*) which are more or less dark brown all over. They are more streamlined than any of the others and are slightly smaller, measuring about 6½ feet across the expanded wings.

The sooties are my favorites among the albatrosses. One of the two, *Phoebastria fusca*, inhabits rather temperate seas and breeds at Tristan da Cunha, St. Paul and Marion Islands, but the other, *P. palpebrata*, is a true sub-Antarctic bird, breeding around the world in the west-wind zone. Both are very tame and you can walk right up to them when they are nesting. Their flight is quite superb, superior even to that of the giant albatrosses. It is often stated that these birds sail on stiffened wings but this is not quite correct, for they are continually making minute flexions to meet variations in the air currents. I have watched Sooty Albatrosses wheeling before their breeding cliffs on calm days when only a breath of air sustained them. From a distance of a few feet it is easy to see how each wing moves in a dozen different ways to catch the best of the breeze. The birds glide along magically, supported, it appears, on nothing at all, like pieces of camphor mysteriously skimming across water in a bowl. If you stand on one of their ledges they may glide alongside and, hanging in mid-air, survey you closely and gravely, mildly curious, an effect heightened by the white crescent of feathers behind their eyes.

Among the albatrosses only the sooties have display flights in which two birds, presumably of opposite sex, glide and turn in the air close together, each like the other's shadow. On the nesting ledges courting birds spend much time preening each other and in reaching forward to flick open their bills and expose the pink interiors of their mouths. They also have a raucous call "peeeooooo," made with the head thrown back

The light-mantled Sooty Albatross has an exceptionally buoyant flight. It does not sail on stiffened wings, but makes minute and constant flexes that take advantage of variations in the current of air

All photographs by the author





and beak pointed to the sky. This is a wild and mournful cry which seems very much in tune with the crags and mists of their sub-Antarctic homes, a cry that has also given rise to the Tristan islander's name of "Peeooo" for the bird.

If you climb to a nest the chick rotates to face you, draws itself up to its full height and makes loud "clap-clops" with its bill. Should albatrosses be new to you, you may think that the sounds are rather liquid in tone — and if you reach forward to grasp the bird, perhaps to band it, you soon discover just how liquid it is. A stream of evil-smelling stomach oil is shot over you, often mixed with what remains of the chick's last meal!

Oil-spitting is a defensive device used by all albatross chicks. It is directed at Skuas and Giant Petrels, which are their only natural enemies. I was interested to discover that this ability to eject oil is best developed when the chicks are first left alone in the nest and that as they grow bigger and stronger the oil flow diminishes. A young bird ready to make its first flight is generally quite dry. One New Zealand observer records that on the Chatham Islands the oil ejected by young Shy Albatrosses (*D. cauta*) was quickly surrounded

by groups of skinks which eagerly lapped up the brown fluid!

There are five kinds of mollymawk. Most are cold water birds and of the exceptions the Yellow-nosed Albatross (*D. chlororhynchus*) lives in the South Atlantic and avoids the colder waters to the south while Buller's Albatross (*D. bulleri*) similarly breeds on islands off New Zealand and ranges over the South Pacific. The rest of the mollymawks inhabit higher latitudes. All differ from the sooties in being colonial nesters. They choose cliffs and isolated rocks on which to build cyclinders of mud or earth, concave at the top, so that their single eggs can be safely cradled. Mature birds generally breed each year and both sexes incubate and help to feed the chick. They may use the same nest several seasons in succession.

Mollymawk displays are more elaborate than those of the Sooty Albatrosses and the many non-breeders at the colonies continue to display until late in the season. There is the usual mutual preening seen in all albatrosses but no vertical trumpeting as with birds of the other two groups. Mollymawks do use a petulant and strident bray-

ing call, however, and also deep sonorous cries with downturned bills and rapid movements of the mandibles giving rise to a strange burring sound. Patches of bare skin at the bases of their beaks are exposed during courtship, while their tails are spread and twisted to one side. At least two kinds — the Gray-headed and Black-browed Albatrosses (*D. chrysostoma* and *D. melanophrys*) — have a strange way of reaching forward to their mates and with bills parallel and side by side, standing motionless for a few seconds before relaxing and switching to some other activity. Once I thought that I was going to see a Black-

A Sooty Albatross incubating its single egg on a low mound of earth. The white feathers in a crescent around the eyes are distinctive, and so is the light stripe on the lower mandible.

The Black-browed Albatross is one of the group called "Mollymawks" by the whalers. It favors cliffs or very steep slopes when nesting. Leg bands for identification may be seen.

brow display to a Gray-head, for two birds were evidently interested in each other, reaching forward tentatively with their bills. But just when contact seemed certain the Black-brow made a false step and fell down the steep slope into the turfs below, looking quite ridiculous.

The two giant albatrosses, the Wanderer (*D. exulans*) and the Royal Albatross (*D. epomophora*), so closely resemble each other that only an expert can differentiate them when in flight. The Royal Albatross, breeding in New Zealand and nearby islands, is less numerous and is probably more sedentary, but three banded birds have been recaptured in South American seas so some evidently cross the Pacific and even round Cape Horn.

Research on the Royal Albatross by New Zealand ornithologist L. E. Richdale and by various members of New Zealand's Antarctic expeditions, and on the Wanderer by Australian biologists, shows that the two have much in common. Both live a long time if they survive their critical early years at sea. The breeding cycle is extended, 11



months elapsing between egg-laying and the departure of the young. As a result, established breeders miss a season and nest every other year. Pairs are re-united in their territories and the males generally return several days before the females. Contrary to the statements of some observers, neither species re-uses its nest; usually the old one has disintegrated by the time a pair returns and a new nest is built in the same general area as before. Richdale found that Royal Albatrosses do not come back to their breeding islands before they are five years old and from the banding data it seems likely that much the same applies to the Wanderer at Macquarie Island, for in the seasons 1959/60 and 1960/61 I came across none of the birds that had been banded there as chicks in the 1956/57 breeding season.

Nesting giant albatrosses of both sexes sit in shifts of two to three weeks' duration and each

fasts during its spell on the egg. Both guard and brood the chick after an incubation period of 9-10 weeks. When it is about five weeks old the nestling is left alone and thereafter the parents forage independently. It seems unlikely that the two ever meet again until their next breeding season, for the young bird is only visited at about 7-10 day intervals. As each parent stays ashore for but a few hours, often for far less, the chances are against both of them arriving at the same time.

The courtship of the Wandering Albatross, one of the giants, includes spectacular dances in which the birds circle each other in a stately and slow ceremony with wings outstretched

Gray-headed Albatrosses have a strange way of reaching forward to their mates and, bills parallel and side by side, standing motionless seconds before beginning another activity.



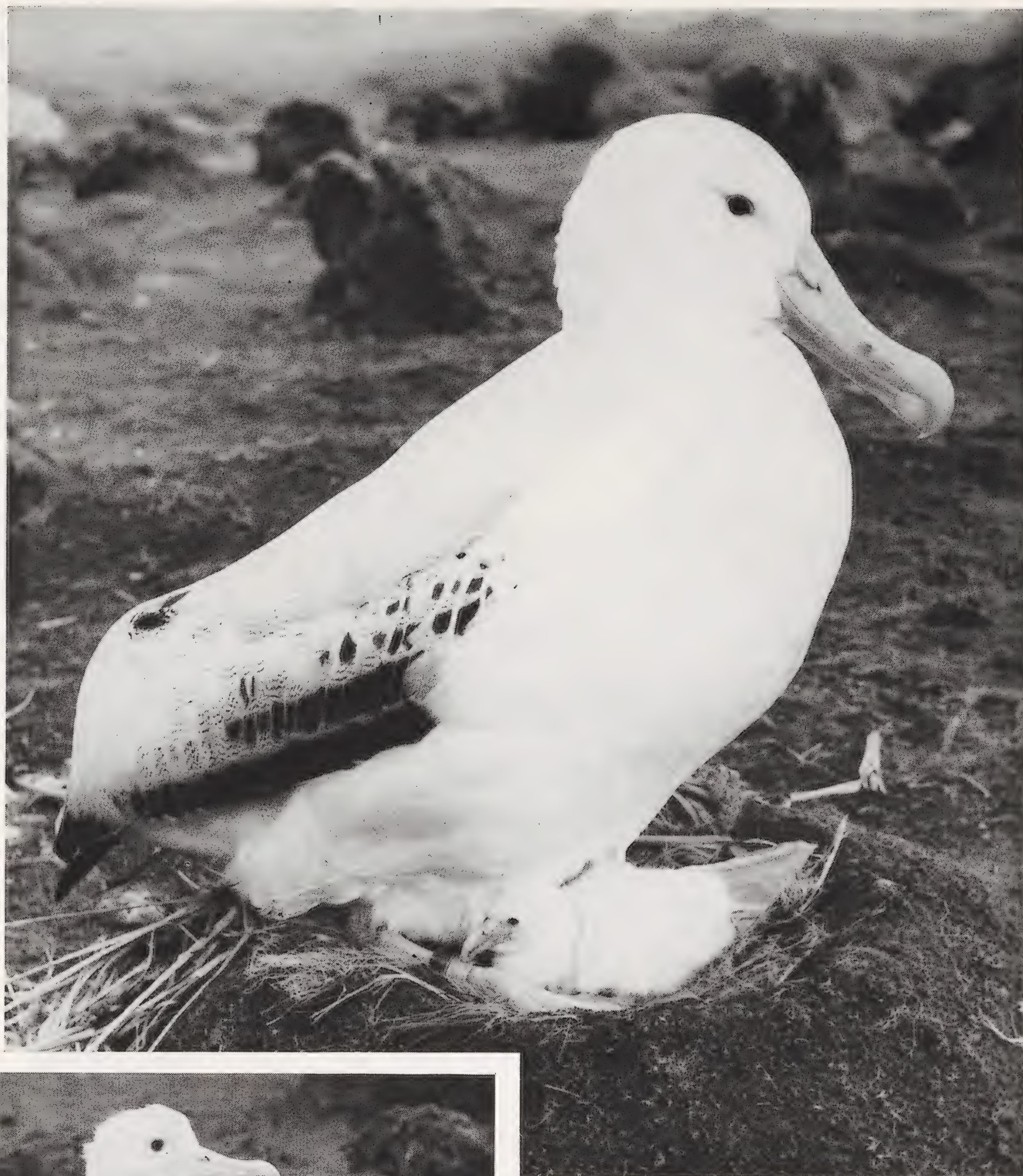


A five-week-old albatrossling is about as big as a domestic fowl. Yet few that reach this age die on land. Skuas and Giant Petrels do not seem to attack them even though the nestlings' only means of defense are its rather soft bill and ability to project a repellent stream of oil. For some reason, introduced cats do not appear to kill the young birds even when they are fast asleep and look easy victims. I did once see a cat stalking an adult Wanderer and anticipated the cat's discomfiture had it pounced, but the animal was evidently not serious and presently lost interest in the giant bird.

Because the parents appear only briefly and erratically during the southern winter to tend their chick, a legend grew up that the young giant albatrosses are deserted by their parents and subsist on their body fat until they fly. Richdale, living among a small colony of Royal Albatrosses, soon disproved this idea for that species. I believe that it was Graham Turbott of the Christchurch Museum, New Zealand, who, dur-

ing wartime service at the Auckland Islands, first established that the Wanderer too tends its chick during the winter, but his work remained unpublished. Since 1956 biologists at Australia's Macquarie Island base have shown that the chicks are fed at intervals right through the snow, gales and sleet of the sub-Antarctic winter and into the Spring. I was lucky enough to see a chick fed two hours before its first flight. It was then 276 days old. As I had regularly weighed this chap from hatching, its departure was like the loss of an old friend. I doubt that the chick viewed the matter in the same light. It never really became reconciled to being stuffed into an old mattress cover when I weighed it and on the day of its departure it looked up as I approached, bag in hand, as if to say "I've had enough of you and your tricks; I'm off," opened its great wings and sailed away westwards into the breeze.

The displays of these giant albatrosses are still more complicated than those of the mollymawks.



An old male Wanderer stands guard over a very young chick. The close-up shows the heaviness of the bill and reveals the shallowness of the cone-nest

At the age of about 5 weeks the chick is no longer guarded. This is the same chick shown in the photograph above — now 110 days old and down-covered.



They include many actions used by the smaller kinds and a dramatic dance in which courting birds side step around each other with their wings held out fully stretched. Such dances are followed or preceded by bowing actions, by upward trumpeting calls and by various bill clapping and vibrating movements.

Despite their size the big albatrosses are not difficult to handle on land. Approach from up wind and they are easily caught—a feint with one hand and you grab the back of the neck with the other. You can then keep the huge and dangerous bill out of harm's way. I developed a technique whereby I knelt on the ground, pinning the bird's neck loosely beneath my instep and so leaving both hands free to fasten identification bands on the legs in order that later biologists could continue the work on birds of known age and antecedents. The bands should last for the lifetime of the birds.

So far I have said little of the lives of albatrosses at sea, about which new light is now being thrown as a result of banding. It seems likely that many of the birds that follow ships out of the breeding season are immature, for none has turned up on the breeding islands unless it is at least five years old. This lends strength to the idea that these sub-Antarctic albatrosses circumnavigate the world in the west-wind zone; indeed,

The same birds as on the opposite page but now the chick (at the right) is 266 days old and is fully feathered in a dark juvenile coat. In the background the birds are Gentoo Penguins.

in five years there would be time for many such round-the-world flights.

Some fledglings do succeed in getting through the "Roaring Forties" to calmer latitudes and there is a general tendency for breeders to move north in the winter. At this season the nesting grounds are deserted except for the occasional giant albatross ashore to feed its chick. Young Yellow-nosed Albatrosses, for instance, born on Tristan da Cunha, winter off the southwest coast of Africa. Many immature Black-brows reach southern Australia; again they are more plentiful in the wintertime. A Wanderer chick banded at South Georgia on November 28, 1958, was caught and released near Sydney on July 18, 1959, which suggests a flight down wind with a northerly component. Perhaps more revealing is the adult Wanderer banded off Sydney on August 23, 1958, which turned up at South Georgia on December 29 the same year. This bird had presumably reached Australia by riding the westerly airstream and returned to South Georgia by crossing the Pacific and rounding Cape Horn, again down wind, all in about four months.

FAMILY LIFE ON LION ISLAND

By JOSEPH A. DAVIS, JR.

Associate Curator of Mammals

LION ISLAND at the African Plains exhibit has traditionally held a group of five or six male Lions — strictly a bachelor affair, for it was feared that the presence of a Lioness or two would lead to hostilities among the males. Under some conditions probably it would, but the unnatural grouping of males has been bothering us for some time — Lions just don't hang around in bachelor parties. Females may cut less imposing figures, but they are an important part of Lions' social organization. And so, when our resident males reached retirement age in 1959 and we were not able to locate male cubs young enough to adjust to group living, we settled for one young male and one young female and decided to build up a natural pride the slow way.

That is why for the past two years we have had only two young Lions on Lion Island, rather than an impressive group of heavy-maned patriarchs. Patience has a way of paying off if you wait long enough, and our Lions brought forth a pair of cubs on January 29. By now the parents have grown into as handsome a pair as one may see anywhere. Charlie has a magnificent mane and Princess has achieved her full growth, muscular but trim. We would like to say that it is the cubs who add life to Lion Island, but that is only part of the truth. Actually, engaging as the cubs are, the interaction of the whole family is the real show.

Charlie was inclined to be rough with the new-



born young, so we banished him from the nursery compartment. Like many new fathers, he did not seem to know that babies are not made to be batted around the floor, and Princess did not know enough to stop him. Since February Charlie and Princess have spent part of each day together (away from the cubs), and as the youngsters grew sturdier we allowed their father to visit them occasionally, for longer periods each time. He was still rough, but the cubs could take roughness now, and in fact seemed to enjoy playing with their sire.

Princess and Charlie have spent most of the sunny days this spring out of doors, but the cubs did not make their debut until March 27. The family's first outing together was not quite uneventful. Charlie bounded from the chute opening out of his winter quarters, dashed across the island and perched on a high boulder, looking majestic, proud and a trifle hammy. Princess emerged less spectacularly, followed by the two toddlers.

Seeing his cubs, Charlie left his rock, strutted over and cuffed the nearest one a few times. We were worried by this until we noticed that the victim kept coming back for more, and that when

the Lioness felt that the play was getting out of hand, she quietly squirmed between her mate and the cub. When this happened, Charlie's attention was distracted and he seemed to forget everything except Princess — until little teeth clamped down on his tail tuft.

The Lion is the only cat whose tail ends in a tuft, and whatever the true evolutionary significance of the terminal adornment may be, it is hard to watch a Lion with his cubs and not believe that the tuft is really there for the cubs to play with.

From his actions, it is easy to imagine that Charlie is proud of his offspring and takes an active interest in them, complete with roughhousing — but within limits. He plays with the cubs on and off during the day, particularly the first thing in the morning, but leaves the routine of family care to his mate while he postures in the sun. It is Princess who must watch the cubs and nudge them away from the steep edge of Lion Island, although Charlie was seen once to pull a cub back from the edge.

That edge has always and unavoidably been a potential danger to our Lions. Although the bottom of the moat is usually wet and soggy, an unexpected fall can injure a Lion. Often in the past the Lions learned to jump down purposely and no harm was done (there is a ramp to bring them easily to the top again), but an exuberant youngster might easily tumble in play from a spot too near the edge. In the years when we exhibited young males only, we purchased new cubs a year or more before they were needed for exhibition, and thus gave them a chance to lose some of their youthful playfulness before turning them

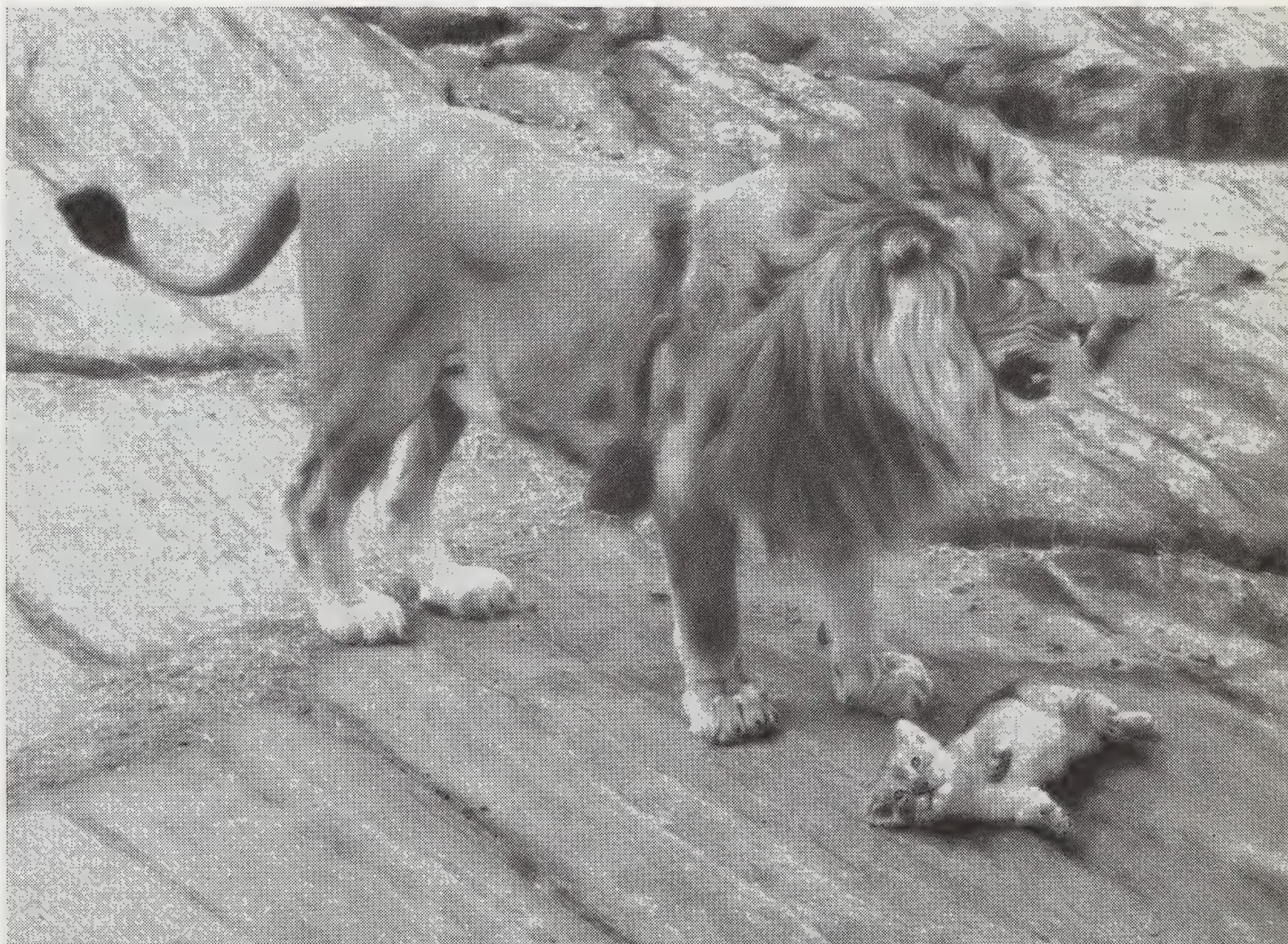
out on the island. The importance of this training is shown by the fact that two cubs, a year old, were lost from spinal injuries incurred in falls in years when we had not been able to give them protracted training. Those two cubs had never seen a precipice, of course.

What of our new babies? We are counting on several factors to keep them safe. For one thing, they are young enough to learn from their mother that the world is not flat. Princess keeps a careful eye on them and does not let them stray too near the edge; by the time they reach their peak of youthful activity and playfulness, they should have learned the limits of their enclosure and have a healthy respect for the steep drop to the floor of the moat.

The cubs, a robust male and a more delicate little female, do not have names yet. They are still just "the cubs," but their personalities are beginning to emerge and soon names will be unobtrusively attached to them. Some day Keeper Herdick, reporting on the Lions, will casually use two names we have never heard before and then the Mammal Department will know that the cubs have been named — maybe not officially but nevertheless permanently.

Although the family is a happily united one, each parent seems to have a favorite. Charlie's is his daughter, and Princess pampers her son. To informed eyes, even the photographs illustrating this article mostly show father-daughter or mother-son activities. If you cannot tell the cubs apart, do not be discouraged. After all, Princess and Charlie have had a great deal more practice in sorting out their offspring and finally deciding which is *their* favorite.

Despite parental expressions which would seem to indicate that the cubs have done something to annoy their parents, there is a very close and affectionate relationship among members of our Lion family.



ZOO NEWS IN PICTURES

Photographs by SAM DUNTON





A pair of White-tailed Gnus came to the Zoo in March 16 after a quarantine in their home country, and another female is on the way and will be received later in the spring after its quarantine in Europe and America. These animals are increasingly rare in the wild and we hope to breed them and establish a herd on the expanded African area. They thoroughly enjoy rolling in the sanded area.

A confused Robin — perhaps the same bird that built on the fire escape on the Zoo's Administration Building in 1959 — has built seven nests and deposited eggs in two before making up her mind which of the many she wanted to use.



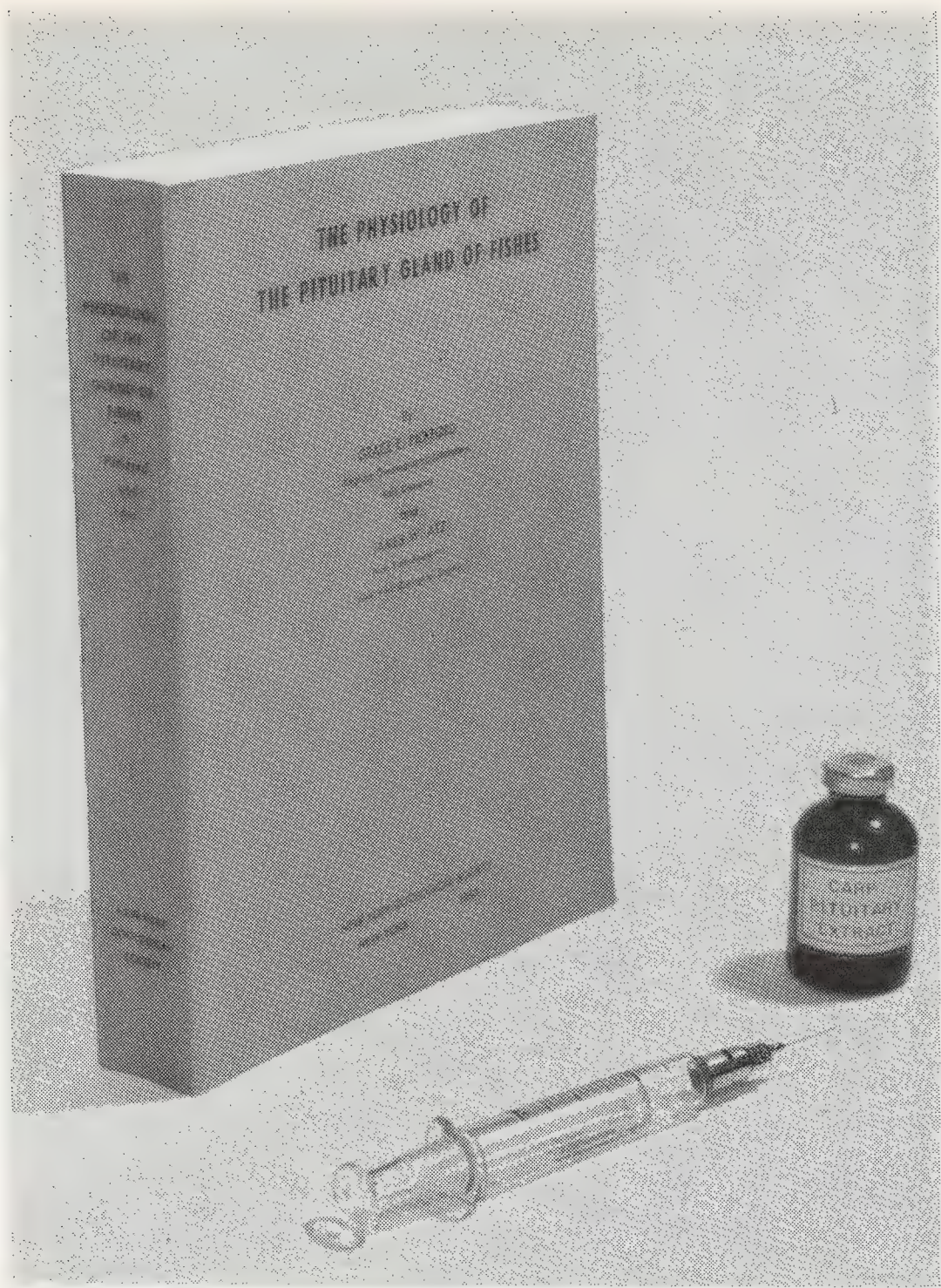
An interesting veterinary problem was presented by a male Thomson's Gazelle which had one horn "knocked down." The animal was restrained, an intravenous tranquilizer was administered, and the dangling horn was splinted by Dr. Gandal by means of a rectangular aluminum splint attached to the other horn.



The first Camel born in the collection since 1928 arrived on April 10. Its name is "Surprise," because we did not know, when we acquired its mother, that she was pregnant. For a few days the mother had to be given a tranquilizer and an oral diuretic before she allowed the baby to nurse; all's well now.



This is just what it seems to be — a kingfisher — although it is scarcely larger than its photograph. It is a Pygmy Natal Kingfisher, from Portuguese East Africa. We received three, the first seen in any zoo in America.



READY REFERENCE FOR THE FISHERY BIOLOGIST

By JAMES W. ATZ

Curator, New York Aquarium

SOMEDAY, PROGNOSTICATORS TELL US, man will farm the sea as well as the land. The pastures of the sea, they point out, are as productive as the best farmlands. No blueprints for this new agriculture exist, however, and we may be sure that the taming of our most impenetrable jungles or inhospitable deserts will be child's play compared to conquering the almighty oceans. There are those who say that it will never be done, and time may prove them right, but even today the *edges* of the sea are being cultivated in various parts of the world. Here, in salt water ponds, millions of Mullet, Milkfish, shrimp and other marine animals are regularly raised for food. There is, of course, a tremendous difference between operating a fish pond and regulating even a small part of the open ocean, but the fact remains that however limited pondfish culture might be as compared with large-scale farming of the unrestricted seas, it is at least a start in utilizing the food-producing capacity of the sea in a systematic, efficient way.

Moreover, pondfish culture is already important in its own right. It provides a significant part of the food of the 1,000 million people for whom fish are the chief source of that vital component

of man's diet, *animal protein*. This holds for the fresh as well as salt water ponds of India, Pakistan, southeastern Asia, Indonesia, Taiwan and the Philippines. In all of these heavily populated areas, foodstuffs from animal sources are the ones most critically in demand, but meat and dairy products are too expensive and their use is also limited by religious taboos, custom and taste, so that fish is the preferred animal protein for both traditional and economic reasons. Accurate figures are not available, but there must be nearly two million acres of ponds now being used to raise fish in the Near and Far East. In the Philippines alone, the investment in the fishpond industry totals more than \$100,000,000.

The principal limitation to the expansion of the fishpond industry in most of the Near and Far East is the number of available fish. Unfortunately, the most important pondfishes will not reproduce in captivity, which means that each year the fish farmer must obtain new stock from the wild. It is as if a cattle rancher had to send his cowboys out on the prairie each spring to catch a new herd of calves. Not only is this expensive, but when the weather is unpropitious for spawning in nature or for the survival of the

delicate eggs or newly hatched fry, there simply are not enough young fish to be had, and the fish farmer must wait a whole year, until the next spawning season, before he can put his ponds into full production. Being at the mercy of the vagaries of nature is certainly poor business, and when the commodity is food, in a region where many people barely subsist and many others are actually underfed, the profit motive joins with humanitarianism in seeking a solution to the problem.

In Indonesia and the Philippines, governmental agencies to help fish culturists were set up during or soon after World War I, but it was not until after World War II that any large-scale, concerted efforts along these lines were made, most of them through the Food and Agriculture Organization. This agency of the United Nations has established an international inland fisheries training center at Bogor on the island of Java to teach fish cultural techniques and has also set up information centers at key locations to disseminate the results of the latest research and statistical analyses. The FAO sends numerous technical advisors to countries all over the world to help them develop their fishery resources. Thanks to this international cooperation, and the work of national agencies of the more industrialized nations as well, pondfish culture is now practiced more widely and efficiently than ever before. Nevertheless, the supply of suitable fish remains a limiting factor in many areas or years. This is especially true of the Milkfish, which is the most popular and important of all the pondfish because of its tasty, white flesh, economical feeding habits and rapid growth. On the average, somewhat more than 600 million half-inch Milkfish fry are netted each year along the shores of the Pacific and Indian Oceans and transferred to ponds, but at least 200 more million are needed to keep the ponds running at full capacity. The situation is serious enough so that the Indo-Pacific Fisheries Council, a subsidiary of the FAO, has strongly urged its members to submit accounts of the progress of their work on the propagation of the Milkfish in captivity to the next Council meeting, which will be held in Seoul in September or October. At Honolulu last September, the Tenth Pacific Science Congress passed a resolution recommending that an international commission, or some other specially staffed and equipped scien-

tific agency, be established as soon as possible to study the Milkfish and its fry.

The concern of the latest Pacific Science Congress with pondfish culture was also expressed through its Fisheries Subcommittee, which issued a report describing the latest advances in fish culture made by its member nations, and its program for the Honolulu meeting which featured three pertinent symposia, one dealing with "Progress in the Culture of Pond Fishes" and two with the hormones of fishes. At first glance, there might not seem to be any connection between fish hormones and pondfish culture, but the fact that hormones control reproduction in fishes, just as they do in the other, so-called higher animals, suggests that hormones might provide the means by which fish that ordinarily do not reproduce in captivity could be made to do so. The use of hormones has, in fact, done exactly that in Brazil, Russia and India and has solved pressing problems in foodfish production there.

The first attempt to use hormones on captive foodfish was made in Brazil in 1931 or 1932, when suspensions of ground-up pituitary glands, just removed from freshly killed fish, were injected into live fish that had become ripe but would not spawn in the ponds where they were being kept. Not five years before, the vital role of the pituitary gland in reproduction had been shown for the first time in experiments on rats and mice. This small gland (in a fish a foot long, it is rarely larger than the head of a match) is found at the base of the brain in all animals with a backbone. Experiments have shown that it controls so many different functions, including the activity of several other glands, that it has received the name of "master gland." For years the chief problem of Brazilian fish culturists had been to get native foodfish to spawn in captivity, and their newly developed technique of injecting fish with pituitary glands or extracts not only solved their own problem but showed the way to fish culturists in other countries.

In the USSR, the problem was to preserve sturgeon that were being prevented from reaching their natural spawning grounds by dams, hydroelectric plants and other man-made obstacles. These valuable fishes, the source of both caviar and flesh, each year leave the sea and travel many miles upstream to the headwaters of Russian



the treatment of captive fish with hormones in order to make them spawn is now a regular procedure in several parts of the world. Here fishery biologists from Michigan State University are injecting species of small minnow with Carp pituitary gland.

Photo courtesy of Robert C. Ball

rivers to spawn. Fish cultural stations, which are located relatively near the mouths of the rivers, now intercept the migrating sturgeon and they are put into holding basins and eventually given injections of extracts from preserved pituitaries collected from sturgeon caught in the commercial fishery. Although the first successful experiments in the Soviet Union were conducted in 1937, it was not until 1957 that all the sturgeon eggs artificially cultured were obtained from pituitary-treated fish. Undoubtedly World War II hindered the development and spread of the technique.

The most recent large-scale application of the method of spawning captive fish by means of pituitary hormones is taking place in India. There, pondfish culture grows in importance year by year, but the shortage of fry of the eight or so

species of "major carps" has always constituted a serious bottleneck to increased production. These relatives of the well known Carp very rarely, if ever, reproduced in captivity, so the Indian fish farmer had to depend on fry spawned in nature. In nature, the fish lay their eggs once a year, during the monsoon season, but when the monsoons failed there were no baby fish and considerable hardship ensued. Even in the best years, there were hardly enough seed fish to go around. In 1957, some "major carps" were induced to reproduce in outdoor tanks or ponds for the first time. During the next three years, 17 million fry were provided in this way for pond culture. This is only a small beginning, however, because a single large Indian carp can be induced to lay nearly three million eggs of which more than half may survive the period of greatest mortality (that is, to the fingerling stage). These figures show the tremendous potential of the method of pituitary injection.

There are many problems yet to be solved, however, especially in the artificial breeding

of marine fishes like the Milkfish or Mullet. Whether some sort of hormone treatment will provide the complete answer remains to be seen. In several parts of the world, scientists are still trying to learn more about how to control the reproduction of these and other commercially important fishes. In the Philippines and Indonesia, the reproduction of the Milkfish is being studied in detail. In Malaya, Taiwan and Japan, the Grass Carp, a species that has so far not responded to hormone treatment, is being investigated. Scientists in Communist China have recently claimed success with two other very important species of pondcarp never before spawned in captivity. In Thailand, fish farmers would like to be able to spawn certain kinds of catfishes and so they are being investigated by fisheries biologists. In Israel, the Mullet is receiving similar attention.

The New York Zoological Society has made an important contribution to this effort to improve the world's supply of food fish. One of its publications, "The Physiology of the Pituitary Gland of Fishes," is a 613-page comprehensive review of practically everything written on the function of the fish pituitary up to the middle of 1956. It has become an almost indispensable tool for anyone working in the field of fish endocrinology, especially the fisheries biologist who frequently finds himself in out-of-the-way places where libraries are poor or non-existent.

It was Dr. Grace E. Pickford of the Bingham Oceanographic Laboratory of Yale University who recognized the great need for a critical review of the scientific literature on the endocrine glands of fishes and who decided to do something about it. Dr. Pickford had been studying the functions of the pituitary gland of the Common Killifish or Mummichog for a number of years, so she was thoroughly familiar with the scope of the field and its principal problems and could establish the basic plan for the projected book. She enlisted my help because I was interested in the reproductive behavior and endocrinology of fishes. When we commenced working together on the project early in 1953, Dr. Pickford and I expected it to take a year or a little more; actually it took four, and our bibliography listed some 1,900 references by the time we were through. Since its publication by the Zoological Society in May of

1957, 882 copies of the review have been sold, more than a third of them to foreign countries — 38 to India and 25 to Japan, for instance. At the rate it is now selling, the book's printing of one thousand copies should be exhausted in about a year.

Pondfish culture does not have any life-or-death aspects in the United States, principally because fish do not comprise a large part of our diet. Nevertheless, the hormone treatment of fishes is being used more and more widely as time goes on. By following the technique developed by Dr. Kermit E. Sneed of the U. S. Fish and Wildlife Service and Dr. Howard P. Clemens of the University of Oklahoma, hatchery men from federal, state and private organizations now each year raise millions of Channel Catfish from parents that were injected with hormones. The same method is also being used to propagate the Flathead Catfish, another fish popular with anglers. Efforts to mass-produce bait minnows or to conserve Pacific salmon and the Lake Trout with the aid of pituitary injections have not yet proved entirely successful, but new developments in the method and type of treatment have appeared right along, so there is no reason to despair. Within the last few years, certain *human* hormones have been found to be surprisingly effective on fishes, although early work had indicated that they were not. Such hormones are standard products of several pharmaceutical houses and are cheaper and easier to get than fish hormones. The most recent development is the discovery that the addition of thyroid-stimulating hormone greatly increases the effectiveness of an injection of gonad-stimulating hormone.

In all these places, at home and in far-flung localities abroad, I like to think that a copy of "The Physiology of the Pituitary Gland of Fishes" rests on a shelf for ready reference whenever a question of *who* did *what* and *why* arises.

One of the ways to measure man's progress is to measure his control over his environment. The ancient art of salt water fish farming is becoming more and more of a science as man learns how to control all phases of the lives of marine fish. If he eventually learns how to get them to spawn at his will, he will have taken an essential step toward making them one of the few truly domesticated marine animals.

“en Brer Fox, he lay low”

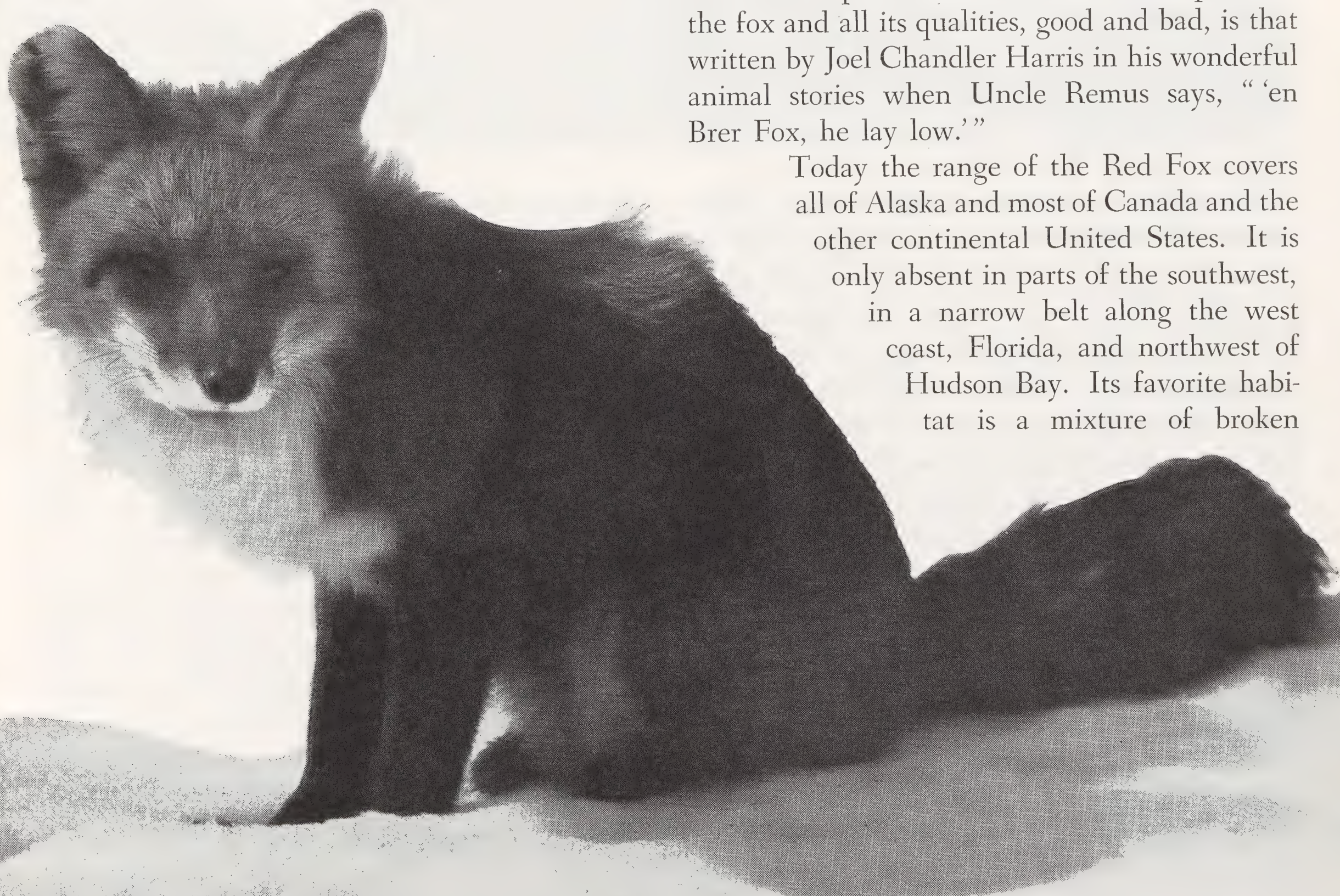
By MILT STENLUND

Regional Game Manager, Minnesota Department of Conservation

AS CIVILIZATION moved west in the United States, and forests were cut, sod plowed and lakes drained, certain birds and mammals were unable to cope with the catastrophic changes. Some, like the Passenger Pigeon and the Woodland Caribou, became extinct, others like the eagle and the Gray Wolf were reduced in numbers to the point where they are considered rare in many areas today. Others, however, had habitat requirements less strict and were capable of adjusting to the new look of the land. In fact some animal populations increased to the point where it is believed they exceeded any found during the days when the American Indian called our land his own.

One of these animals which has demonstrated the remarkable ability to “roll with the punches” is the Red Fox. For centuries, predators have been a favorite topic in prose, verse and fable. The fox, more often than not, has been the primary target of the authors. The fox is not a large and powerful animal. It is credited, however, with the cunning that equals or sometimes surpasses that of human beings. It lives contentedly in close association with people, is seen frequently by persons spending time in its haunts, and its tracks and signs are readily recognizable. It appears to live by the philosophy that it likes us and will be with us for some time. When one digests the results of popular fox control programs, the only conclusion is that thus far the fox has us beat. Perhaps the most succinct description of the fox and all its qualities, good and bad, is that written by Joel Chandler Harris in his wonderful animal stories when Uncle Remus says, “‘en Brer Fox, he lay low.’”

Today the range of the Red Fox covers all of Alaska and most of Canada and the other continental United States. It is only absent in parts of the southwest, in a narrow belt along the west coast, Florida, and northwest of Hudson Bay. Its favorite habitat is a mixture of broken



woods, pasture, croplands and rolling hills. Here it finds den sites in side hills, its favorite food in the form of various rodents, and cover in the fence rows, brush areas and woods of this type of country. It is equally at home, however, but in lesser numbers in the wooded draws of the prairies, the spruce-fir forests of southern Canada and the lake states, and the hardwoods areas of the eastern states.

for and feeding the young, a trait not common among many of our game animals. After a summer in which the den has served as a base of operations, the young leave the family surroundings to strike out on their own. Trapping and tagging of these young foxes in Michigan has shown that the males traveled an average of 43 miles before being caught, the extremes being one and a half miles and 73 miles. The females



The Red Fox is actually a much smaller animal than most people believe — it is largely a bundle of fur. Its weight of eight to twelve pounds is less than that of most healthy tom cats. The long fur and the tail make it appear larger. Colors come in several phases, the red coat with black feet and black outer ears being the most common. The white-tipped tail is always present and an identifying feature. Other color mutations are the Cross Fox, which shows a dark cross pattern on the withers, and the once highly valued Silver Fox — black with silver tips on the guard hairs.

In early spring a mated pair dig a den, preferably in a side hill with a view, or find the abandoned hole of some other digger such as the Badger. After a gestation period of fifty-one days, a litter of four to nine is born. The average size is five. Both parents take the responsibility of caring

averaged only eight miles of travel. Of probably more importance was the fact that this study and another conducted in New York showed the average life span to be only about six months. Just as in small game birds and mammals such as the pheasant and the rabbit, the life span of the fox is short, the population turns over rapidly, and new animals quickly replace those that have died or been killed. This is of great importance when the question of bounty control is argued.

After the young have settled in an area to their liking, they establish what is known as a home range where they do daily hunting. This territory was found to be about 900 acres on a day-to-day use basis.

The diet of the Red Fox is as varied as the species of animal and plant life found in its home range. Although classed as a carnivore or flesh

eater, the fox also eats a great variety of fruits and vegetation. Perhaps the only generalization which will hold true is that the fox feeds on foods which are most readily available. At times this could range from gophers to grapes or from barn rats to bugs. This diet is accepted as harmful or beneficial by human beings depending upon how it directly affects them. A fox in one locality is hated for eating pheasants yet welcomed by the local orchardist because it kills tree-girdling mice.

In Michigan, foxes are meat eaters in the winter, feeding largely on mice, rabbits and farmyard carrion such as dead cows, sheep and chickens. Except under unusual conditions, pheasants and other birds are ignored. In spring and summer the diet changes to insects and fruits and less meat. In the fall, fruits and mice are important but again crippled and dead game animals and birds become important.

In Iowa, detailed food habits studies on two areas showed that meadow mice were high on the preference list but that foxes quickly took advan-

taken, although 19 were found dead by the foxes and 223 were flushed by the biologists making the study.

In a study in the northeastern states which took a number of years it was concluded that the summer food consisted mainly of small mammals, fruits and berries, birds, insects and reptiles. And to show adaptability, the fox along the Atlantic Coast ate sea birds and their eggs, fish, and food washed up on the beaches.

From these factual and detailed studies conducted in various areas on differing habitat it is evident that the fox is no fussy eater, that fruits are taken as readily as meat and that small mammals, particularly mice, form the mainstay of the diet. On one occasion I had an excellent opportunity to watch a Red Fox hunting for mice. While driving a back road at sunrise in October in northern Minnesota I noticed a Red Fox hunting a wild hay meadow along the road. I stopped the car when it was apparent that the fox had not heard my approach. For several minutes the busy animal worked his way across the meadow, trotting slowly then pausing to sniff. Suddenly it would raise its front feet and pounce on a tuft of grass presumably hiding a mouse. It reached the road about one hundred feet behind the car without catching a single animal. Next it calmly trotted back up the road, into the yard of a rural resident, around the house, and into the open back door. The fox remained inside about a half minute, reappeared with nothing in its mouth and trotted off into the nearby woods. Surely this animal has little fear of our civilization and its development.

The case against the fox is usually based on the assertion that it is a poultry killer in farming areas and a game killer in the wild. The assumption is made that each game animal the fox takes means one less in the hunter's bag. More and more evidence is being accumulated, however, to indicate that this premise is not necessarily true.

Proof that foxes kill and eat game is often based on the evidence of carcasses, bones and feathers found at or near den sites. The same materials are also found in fox stomachs and in fox droppings. The professional investigator does not deny that foxes take game or chickens, he merely questions whether *all* pheasants, *all* rabbits, or *all* chickens found at den sites, in stomachs, or in

civilization and wild animals seldom mix, but it is different with the Red Fox; he has held his own or has increased over much of North America. In recent years foxes lived in N. Y. Botanical Garden!

Photo by Wisconsin Conservation Department

tage of sudden catastrophies in animal populations. A sudden severe blizzard provided a great number of storm-killed animals. A drouth made Muskrats homeless and exposed them to fox predation as they sought water. In examining occurrences of pheasants in the diets it was found that birds in poor or marginal habitat suffered greatest losses. In this study cock pheasants were taken more readily than hens, egg predation had little effect on over-all pheasant numbers and there was little predation on young birds.

In Michigan an interesting study was conducted in which observations were made on 1,109 miles of fox trails in Ruffed Grouse range during the winter. It was found that predation was negligible, that the bulk of the food was illegally killed deer left over from the November hunting season (as much as 400 pounds per square mile) and that foxes still hunted mice extensively. *Five cottontail rabbits, two quails and one hare were the only game actually killed on the thousand miles of trails.* Not one Ruffed Grouse was





litter of 4 to 9 young is born in the spring after gestation period of 51 days. The little Foxes stay with their parents as a family unit during the first summer and then leave to make their own way.

Both photos by Michigan Conservation Department

droppings were actually killed by the fox since no one actually observed the first meeting of the predator and the prey. If this premise were true, then it also must be true that if horse hair or cowhide or moose hair were found at the fox den or in a fox stomach, the fox had killed the horse, the cow and the moose.

Food habit studies are difficult at best when such variables as discarded dead farm stock, deer killed illegally by hunters, and millions of car-killed mammals and birds along our highway enter the picture.

The fox does take game, but under conditions of weather and habitat that are near what one could call normal the effect of predation on game numbers is negligible. In a large scale experiment in New York the fox population was reduced drastically on a study area in order to increase the number of pheasants. The reduction in fox numbers did not increase the pheasant

population appreciably and certainly not to a degree commensurate with the cost.

Although sportsmen in Michigan blamed pheasant declines on foxes, it was shown that pheasants also declined on areas where there were no foxes and the same declines appeared in fox-less areas in South Dakota.

In the light of the Michigan studies, it appears that it would be highly impractical to attempt to increase pheasant numbers by reducing fox populations.

In assessing the fox-poultry problem, the unpopular conclusion has been reached that following recommended poultry husbandry practices in construction of hen houses and yards would eliminate most predation.

With the observance that foxes kill chickens, rabbits and pheasants, it was only natural that demands be made to eliminate the fox and the time-honored method to be employed should be the bounty.

I will not delve into the pros and cons of the ancient bounty system of animal control. I will mention, however, that the major share of the millions of dollars spent for bounties goes for fox

payments. How has the fox responded to this hallowed system, revered especially by the bounty trapper? Present fox numbers would indicate that the fox doesn't even know the system exists. Fox populations have gone up and down in major build-ups and declines despite bounty payments in most states.

The number of foxes bountied in Minnesota reached an all time high of 54,000 in 1959, an increase of 20,000 in ten years despite bounty payments. In Michigan the number increased from 21,000 to 27,000 in six years despite the fact that \$800,000 has been spent on claims.

Why then, if overwhelming evidence from all areas shows the fraud, waste and politics connected with the system, do bounty payments continue?

For several reasons some farmers still believe that bounty trappers help solve his individual problems, some sportsmen still believe that a bird saved from a fox automatically ends up in his pot, certain local politicians dare not take a stand against the system for fear of losing votes, and in some cases the bounty payments act as a welfare program providing cash to rural residents hard put to making a decent living. Unless well informed sportsmen and sincere citizens take an active interest in this phase of conservation and bring it to its logical conclusion, I am afraid the notorious bounty payments will be with us for some time to come.

The tragic part of the entire problem is the undisputable evidence from many areas that fox bounties do not control fox populations, that bounty payments do not materially increase game numbers and that in many cases from one-half to three-quarters of the animals taken would have been killed even though no bounty were paid. These were animals killed incidental to other hunting or killed by autos on the highway.

Although the fox presents little actual danger to game populations it can become a menace at times to human beings and to domestic stock as a transmitter of the serious disease of rabies. Outbreaks of rabies were widespread in the eastern states in the 1940s and incidence of infection was high in Red and Gray Foxes. Organized trapping of foxes reduced the danger level of the disease and it was shown that extermination of foxes was not necessary. It is likely that this disease

problem is of far greater danger and importance to our society than the pressure the fox exerts as a predator.

Are there direct economic benefits in a fox population? Decidedly so. The enormous appetite for mice gives some protection to farm crops and orchards.

Fur prices at present are in a general slump and long-haired pelts such as the fox even more so.

At one time fox trapping paid off for the pelts alone, with the freak Silver Fox bringing many hundreds of dollars. There is little value in the fur today, due partly to tough competition from artificial fibers. A change in demand or style, however, could make fox trapping profitable again.

Fox hunting as a sport is becoming increasingly popular. The use of horse and hound is restricted to local areas in the east but weekend fox hunts with packs of hounds and the hunters in cars and on foot are common in the midwestern states. Hunting with the use of commercial predator calls also has appeal. Tests in Minnesota have shown that a camouflaged hunter or camera fan in a well chosen blind can successfully call in a fox in about one out of seven trials. This sport is inexpensive and is challenging, for site, wind direction, cover and terrain must all be considered before calling has a chance.

In summary, the Red Fox is a versatile animal quite capable of adjusting to a variety of environments, many of which include people. Its role as a controlling factor on game numbers has been highly over-rated and its detrimental effects on stock could be reduced materially if proper animal husbandry practices were initiated.

In certain areas control of numbers may be necessary, especially when danger of rabies is present. But the bounty system will not bring about this control. Organized trapping under guidance and an extension trapping and instruction program has been the answer in some cases.

The fox offers recreational opportunities which will become more popular as pressures on game numbers increase. There is no doubt that Brer Fox will be with us in the foreseeable future, for the traits of cunning and slyness attributed to him in legend and fable have taught him to "lay low" when danger appears.

News from the Conservation Foundation

Survey of the National Parks

A two-and-one-half-year study entitled "Man and Nature in the National Parks" has been launched by Dr. Frank Fraser Darling in cooperation with the National Park Service. The survey is made possible by a grant from the Old Dominion Foundation. Its purpose is to assay the pressures placed on the parks by ever-increasing millions of visitors — to seek solutions of the dilemma the parks face in providing both recreation and unspoiled scenic beauty at the same time. Dr. Darling will visit as many of the areas in the National Park System as possible, including — this summer — Alaska, the Northern Cascades, the Grand Teton National Park, Glacier, Yellowstone and Rocky Mountain National Parks, and Craters of the Moon and Dinosaur National Monuments. Subsequent field trips will be made to the Southwest, California, the South, and the parks in the Middlewest and the Northeast. The remainder of the field work will be completed in the summer of 1964.

White House Conference

Fairfield Osborn and George Brewer attended the White House Conference on Conservation on May 24 and 25. Held in the State Department Auditorium, the conference brought together for the first time conservation spokesmen from throughout the country, as well as Federal, State and Congressional conservation authorities, for a discussion of "Conservation for the Sixties." The program included four panel sessions, two featuring Federal cabinet officers, one composed of the members of Congress and one of State Governors. President Kennedy and Vice-president Johnson were principal speakers, and Chester Bowles spoke on the problems of land reform around the world at a luncheon on May 24.

Wildlife Reconnaissance in Alaska

Dr. Darling this summer will activate a new study, sponsored by The Charles E. Merrill Trust, directing and coordinating an ecological

and wildlife reconnaissance in Alaska to be conducted by Dr. Frederick C. Dean, head of the Department of Wildlife Management of the University of Alaska. The field work should be completed this summer. Following up Dr. Darling's previous examination of hoofed wildlife in Alaska in 1952, this project will center specifically on the area west and northwest of Fairbanks, across the Yukon valley and the drainages of the Koyukuk and Kobuk rivers as far as the Baird Mountains. It will reassess the wildlife situation in Alaska with a view toward giving direction to the new state's future management of natural resources.

Briefly Noted

President Ordway and Dr. Darling will lecture on June 21 at the Stonier Graduate School of Banking, New York — their subject: resource utilization and its economic implications . . . Of the movies which the Audio-Visual Department judged for the American Film Festival at the end of April, "Durum: Standard of Quality" won in category #1, "Agriculture, Conservation, Natural Resources," and "1959-60 Eruption of Kilauea" won category #12, "Nature and Wildlife" . . . The working title of Martha Munzer's new book, to be published by Alfred Knopf, is *Our Town: Today and Tomorrow* . . . Sponsored by The City and Country School, Dr. Brandwein spoke on April 16 on "Structure and Substance in Elementary Science" in the auditorium of the New School for Social Research . . . Noel Eichhorn spent four days in Washington in the beginning of May making preparations for the National Parks Survey, and, particularly, to learn more about the use of the areas adjacent to the parks . . . Publications: *A Sourcebook for Elementary Science*, by Elizabeth Hone, Alexander Joseph and Edward Victor, edited by Paul Brandwein; *A Sourcebook for the Physical Sciences*, by Alexander Joseph, Paul Brandwein, Evelyn Morholt, Harvey Pollock and Joseph Castka — both are textbooks for teachers, published by Harcourt Brace.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

New Bird of Paradise Has a Distinguished Provenance

The Zoological Park has been without a Bird of Paradise in its collection for almost a year and efforts to obtain one from unsettled New Guinea have been fruitless. We were consequently delighted when Edward Marshall Boehm, a Patron of the Society, agreed to a part-gift, part-trade of his adult male Twelve-wired Bird of Paradise. Especially since it is a bird with a distinguished provenance.

Director Conway saw this particular bird in 1958 in the collection of a London aviculturist and was told that it had once belonged to the late Sir Alfred Ezra, a well-known aviculturist. It was acquired by Mr. Boehm more than a year ago — and now we have it.

Our last previous Twelve-wired Bird of Paradise came to the Zoo in 1929 and lived for almost 21 years. The newcomer is obviously old but is vigorous and tame and has settled into the collection nicely.

Dr. Osborn Receives Medal

The Medal of Honor of the Municipal Art Society was awarded to Dr. Fairfield Osborn on May 15, at a ceremony at City Hall, in recognition of the educational and aesthetic value of his work as president of the Zoological Society. The medal had been awarded only six other times since the founding of the Municipal Art Society in 1892.

Collecting Trip

Dr. Klaus D. Kallman, in charge of the Genetics Laboratory of the Aquarium, returned from a ten-days' collecting trip to Mexico and Texas on April 27. In Mexico he fished for two species of the small, live-bearing platyfishes, and in Texas he obtained Amazon Mollies. The fishes were brought back alive to the Laboratory where Dr. Kallman will make fin transplants among the members of each species and their respective off-

spring. This technique reveals how closely a particular fish is related to its neighbors and thus to what extent it may be inbred. Such information about the natural populations of animals is needed before their evolution can be understood.

Giant Octopus — Not Timid — at the Aquarium

Since March 21 the Aquarium has been exhibiting a Giant Pacific Octopus, *Octopus apollyon*, with an arm-spread of about seven feet and a weight of about thirty pounds. This is quite the largest octopus that the Aquarium has ever exhibited and one of the least shy as well. It spends much of the time in full view of the public, actively moving its tentacles, and sometimes even feeds in broad daylight.

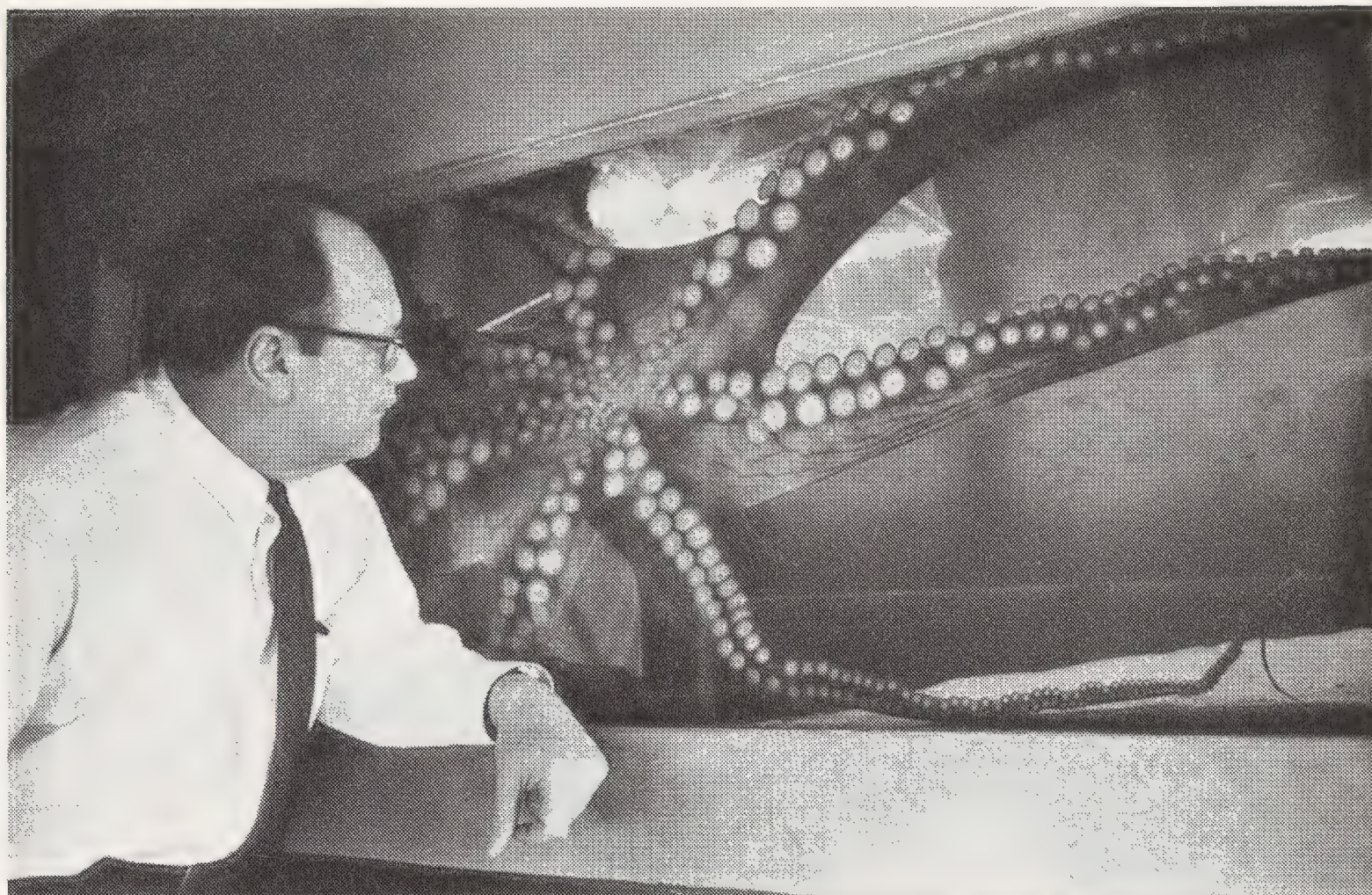
The specimen was a gift from the Vancouver Public Aquarium through its Curator, Dr. Murray A. Newman. It had been captured last October in Horseshoe Bay near Vancouver, when it weighed only five pounds. Fed at least two large crabs each week and all the fish it would eat, it grew rapidly. In preparation for shipping, the octopus was gradually cooled to a temperature close to 32 degrees Fahrenheit. This slowed down its metabolism, putting it into a semi-torpid state. Assistant Curator Donald W. Wilkie then sealed the animal in a plastic bag with ten gallons of chilled sea water and an atmosphere of pure oxygen, and then packed the bag in ice in an insulated container. This elaborate procedure, which was developed at the Vancouver Aquarium, enabled the octopus to make the twelve-hour airplane trip to New York. — J. W. ATZ

IN BRIEF

Another Palm Civet. An African Palm Civet was born in the Small Mammal House on May 16 — not a rare occurrence, but interesting because we were able to determine the gestation period, which was apparently unknown. It was 64 days.

Aquarium Director Coates takes a close look at the Giant Octopus. Behind the animal may be seen a plastic bag of ice, used for a time to cool the water. A mechanical refrigerating system is now in operation.

New York Times Photo



Cold-water Anemones. The cold waters along the Pacific coast are inhabited by some of the most spectacular invertebrates in the sea. Giant and colorful sea anemones, starfish, mollusks and worms are some of them. The Aquarium has received three small trial shipments of these animals from the Steinhart Aquarium in San Francisco, and if they thrive in the 53-degree water from the Aquarium's saltwater wells, we shall attempt to get more and larger specimens.

Busy Incubators. So far this year the production of eggs by birds in the collection is running well ahead of last year, when we collected 1,238 eggs in the twelve months. At the end of May — the month of greatest production — we had picked up 900 eggs. By no means all of these are incubated, but so far we have hatched Laysan Teal, Chestnut-breasted Teal, Cape Teal, Copper Pheasant, Golden Pheasant, Chilean Widgeon, Gray-lag Goose, Ashy-headed Goose, Magellan Goose, Black-necked Swan, Wood Duck and Kildeer.

Lollypop. Although we usually like our animals to be tame — it often simplifies handling — sometimes they are *too* tame and consequently too demanding of their human friends. That is the case with a young Ratel, or African Honey Badger, received in May from Mrs. Dora Weyer of Liberia. The Ratel's name is "Lollypop" according to the legend on its shipping box — a name probably chosen because it often makes popping sounds with its mouth. Lollypop has high stand-

ards of what he expects from people, and demands constant attention whenever he is awake. For the first ten days members of the staff took him home at night, but now he sleeps in the Zoo at night and leads a full and joyous life in the Education Department's offices by day.

PUBLICATIONS OF INTEREST

DOLPHINS. THE MYTH AND THE MAMMAL. By Anthony Alpers. xviii + 268 pp., 20 photos. Houghton Mifflin Co., Boston, 1961. \$5.00.

Dolphins and porpoises are now riding a great wave of popularity. We see it reflected in the number of queries about them received at the Zoo and Aquarium. Now there is a popular book on the subject that we can wholeheartedly recommend, for although the author is a journalist with no biological training, he sought the advice of a good many experts and, what is more, followed it. — J. W. ARZ.

THE STORY OF A NATURAL HISTORY EXPEDITION. By Russell Francis Peterson. Illus. by the author in color and black-and-white. 56 pp. Doubleday & Co., Inc., Garden City. \$2.95.

In the preface to this slim but attractive and lavishly illustrated book, the author says that "To go on an expedition . . . has been a dream common to us all." Broadly true, of course, but since such dreams are seldom translated into reality, few learn at first hand what a natural history expedition actually is like. Fortunately for dreamers of all ages, Mr. Peterson's ambition has been amply realized and he has been able, succinctly and well, to give an account of such a trip. In the fewest possible words, he has given a brief but accurate description of southeastern New Guinea and its primitive inhabitants, as well as authentic impressions of its mammals, birds, reptiles and insects. The aspiring expeditionist will learn much of what is entailed in such a project and may even pick up a few words of authentic Motu — just in case! — L. S. C.

New Members of the New York Zoological Society

(Between March 1 and April 30, 1962)

Life

Alfred W. Baldwin
David A. Lowry

Supporting

Norman E. Blankman
Walter Burke
Robert E. Clayton, Jr.
Mrs. Charles Dewey, Jr.
Joseph C. Fox
William H. Gregory, Jr.
Mrs. Frederick Rueckert, Jr.
Philip Zahn

Contributing

Mrs. John W. Allen
James K. Berman
Richard H. Blanding
D. Cameron Bradley
Dr. Robert G. Brayton
Edward C. Brewster
Miss Georgiana E. Brooks
Mrs. Henry W. Bull
Henry C. Carpenter
Dr. George H. Childs
Mrs. George H. Childs
Mrs. Nicholas L. Coolidge
Mrs. Edgar M. Cullman
Miss Harriet S. Curtis
Richard H. Dana
Mrs. A. M. Dodge
Mrs. W. F. Dominick
Mrs. Bronson B. T. Eden
Harry Elbaum
David L. Ferguson
Roy K. Ferguson
Zachary Finkle
Dr. Virginia Kneeland Frantz
Roger D. Hale
Grant Keehn
Mrs. J. A. Kingsland
Victor W. Knauth
Mrs. Lee Anne Larsen
Mrs. S. J. Lehman
John Lowry
Kenneth P. Markman
Mrs. J. W. Middendorf
Mrs. Seth M. Milliken
Nicholas M. Molnar
Mrs. Walter R. Moore
Paul O'Brien
Mrs. P. S. Paine
George R. Puckhafer
Mrs. Joan B. Reed
Mrs. Ogden Reid
Mrs. Henry L. Schwartz
Harry Seemann
Mrs. Charles N. Shepard
Arthur B. Singer
Mrs. James Kellum Smith
Davidson Sommers
Oakleigh B. Thorne
Charles S. Trattler
Miss Jane Wasey
George W. Young

Annual

Mrs. Paul Abbott
Lewis G. Adams
Mrs. Lewis G. Adams
Mrs. James B. Baldwin
Mrs. Robert C. Baldridge
Richard P. Barden
Mrs. C. Bathgate Becker
J. A. Blackmer
Frank J. Boylan
William M. Brady
Dr. Thomas L. Brayboy
Dr. Pierre R. Bretey
Mrs. Warren D. Brewster
James L. Buckley
William B. Buhlman
Miss Elsie B. Bullock
John S. Burdick
Mrs. F. Higginson Cabot
Peter B. Cannell
Mrs. Oliver B. Capen
Mrs. G. M. Carnochan
Mrs. D. K. Chapman
Mrs. Thomas L. Clarke, Jr.
Harris Clay
Mrs. G. Jarvis Coffin
Dr. Irwin R. Cohen
Miss Mary Ely Colonna
Vincent Corbellini
Mrs. Jeannette W. Cross
Mrs. Elizabeth R. Cushman
Mrs. Laurence B. Dunham
Mrs. Morris Earle
Coy G. Eklund
Eugene F. Feyl
Augustus B. Field, Jr.
Stephen Frankfurt
Herbert Fritschy
W. D. Gaillard, Jr.
Fred Gwynne
Louis Halpryn
Miss Marta M. Hanacik
Mrs. Maurice F. Hanson
Mrs. Basil D. Henning
William G. Hisnay
Mrs. M. Henry Hoepli
Mrs. John Gregory Hope
Mrs. Michael Horneffer
Mrs. John W. Hughes
Miss Lynn Israel
Mrs. Minnie Cassatt James
Mrs. George J. Jordan
Elias Karmon
Bertram Katz
Mrs. David Kennedy
Mrs. Morris Ketchum, Jr.
Mrs. Maria Kidder
Mrs. Wilmer Kingsford
Mrs. Walter Kingsland
Miss Annette S. Kirby
Frederic M. Kirkland
Mrs. H. Irgens Larsen
Paul Allan Levine
Mrs. B. U. Livingston
Joseph B. Locke
Mrs. Thomas F. Long

Mrs. N. Lucas Longstreth
Mrs. Henry Lopez
Mrs. May S. Luchauer
George M. MacDonald
Mrs. C. Jerrold MacGuire, Jr.
Dr. David Marshall
William Holt Mawhinney
William W. McCandless
Mrs. Standish F. Medina
Elias Messing
George F. Metz
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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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At the meeting of the Board of Trustees of the Zoological Society on June 19 the following Resolution was adopted:

WHEREAS, William Beebe commenced his remarkable career as a member of the staff of the Zoological Park on October 16, 1899, and

WHEREAS, he brilliantly served the Society's purposes for the advancement of zoological knowledge in active service for a span of over fifty years until his retirement on July 29, 1952, and thereafter continued his extraordinary and dedicated work until the day of his death on June 4, 1962, and

WHEREAS, during this prolonged period of time he gained a preeminent position both in this country and abroad as a naturalist, a scientist, as well as an author and interpreter of the natural living things of this earth, and in so doing he contributed immeasurably to the purposes and prestige of the New York Zoological Society,

NOW, THEREFORE, BE IT UNANIMOUSLY RESOLVED that the Board of Trustees of the New York Zoological Society hereby records its deep personal loss at the death of William Beebe, and its profound admiration and gratitude for his achievements and for his unparalleled contributions to the purposes of the Society and the advancement of zoological knowledge throughout the world.

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HARPS AND HOODS AND HELICOPTERS

By CARLETON RAY

Associate Curator, New York Aquarium

IT WAS EARLY in the winter of 1962 when Paul Montreuil, Director of the Quebec Aquarium and an old hand at sealing, suggested that his institution and ours cooperate on a sealing venture in the Gulf of St. Lawrence. It appeared that something new was brewing in that most southern of the world's sub-Arctic waters.

For years previously, the sealers had gone out onto the ice, working from specially outfitted ships that lunged and cracked and threaded their way to the Harp Seal herds. Sometimes ships froze in. Occasionally one did not return from the treacherous frozen sea. This year, the ships would again go out, but they would now compete with helicopters. Paul had carefully outlined the possibilities and probabilities of helicopter live capture to me and in very little time had me convinced that there was much to gain and little to lose in the attempt. To gain: the rare (in captivity) adult and pup Harp and Hooded Seals that might be caught with soft nets and transported by helicopter and plane and truck in jig time. To lose: a very nominal sum and a very few days. In the balance, the odds were for the try. And so, on March 11, I climbed into the Aquarium carry-all to meet Paul and his chief collector, John-Fred Leblanc, in Charlottetown, Prince Edward Island, the following Monday, March 13.

We would be seeking two species rare in captivity — but by no means rare in the wild, however. The Harp or Greenland Seal, *Pagophilus groenlandicus*, is the seal of the sealing industry, due to its unfortunate — for the seal — habit of herding in vast, packed groups to whelp on the ice during the first weeks of March. The Harp Seal gets its name from the harp or U-shaped dark marking on its back which, together with a

silver-white ground color and black face, produces a beautiful animal. The Acadians know the Harp Seal as the Loup-marin de Glace or "ice seal," an appropriate name since individuals rarely if ever come on land. The sea ice is their home. It is not often exactly a simple matter to get in through the ice to the seal herd, but once the sealing boats make it in, the slaughter is a mass-production matter. There were, only ten years ago, some five million Harp Seals in eastern Canada in two major herds — a larger one in the Straits of Belle Isle and a smaller one between Prince Edward and the Iles de la Madeleine. Now there are only about half that number and unless officialdom wakes up soon to regulate the catch for a sustained yield, there may be far fewer in a short time.

Much has been written, sometimes emotionally, about the slaughter of the pup white-coats, as Harp Seals are called in their first weeks of life. I find it hard to condemn the sealers for pursuing their livelihood, any more than we would condemn the slaughterhouse for supplying good beef. As long as there is a demand for fur and oils, the fat and the coats of seals will be taken. Nevertheless, it is time to recognize these seals as a valuable resource and manage the stock accordingly. Perhaps this will take international legislation. At any rate, this was the operation we were to see and join, in a way, and one cannot avoid some mixed feelings.

The second seal species we were after was the Hooded Seal, *Cystophora cristata*, a large and

This baby Hood Seal, being held by Paul Montreuil, Director of the Quebec Aquarium, went to Quebec to round out a family of Hoods. On the same expedition a female and baby were captured for New York.

All photographs by Carleton Ray



dramatic beast, the males of which approach 1,000 pounds and are 8-9 feet in total length. The ground color is a lovely, soft blue-silver and the animal is heavily spotted with almost black markings, irregularly placed. But the most marked feature of the Hooded Seal is the hood. This species is rather closely related to the Elephant Seal and like that seal possesses an inflatable nose. In the Hood's case, the nasal sacs of the male can be extended into a large balloon, large enough to obscure the seal's head when viewed from the front. It is inflated in threat when the seal is approached, and makes an awesome appearance. The female, about two-thirds the size of the male, has much smaller nasal sacs, barely discernible. This is the Loup-marin de Poche, "pouch seal," to the people of the Madeleines and with them its reputation is awesome. They tell tales of sealers coming up to the "poches" by surprise and of being attacked and mauled — or worse. We suspected, however, that as in the case of most wild things, the seals had no greater desire to be hurt than we did and that we would come to fairly good terms mutually.

By now, anyone who has read in this magazine some of our northern adventures while capturing whales and walruses, would feel that we are perhaps justified in accusing the Arctic of having something of a personal nature against expeditions of the New York Aquarium. As if knowing

that we were on the way, the weather turned from lovely, warm, sunlit and clear as only the north can be, to bleak, windy, wet and miserable as only the north can be. Nevertheless, our stay in Prince Edward Island was very pleasant if meteorologically tedious. It gave us the opportunity to become acquainted with Paul's friends who were running this sealing-by-helicopter venture: the boss Dr. Marc Arsenault, and his foreman, massive and ever-smiling, friendly, gentle Alphonse Doyle, one of the youngest and best of the Madeleines fishermen. For them, the weather was more than frustrating. It could be disastrous.

Finally, on March 16, the weather took a good turn and the winds blew the seals on their ice closer to the Iles de la Madeleine and so we moved from Prince Edward to those islands. The next day we drove to Amherst Island past long stretches of sand beaches and past the hills of red, sandstone earth that are the mark of much of the Maritimes. Hardly a more picturesque or better-kept place could be imagined — these small islands of about 14,000 persons so honest and friendly that until a few years ago there was no police force and at present only a token one.

When a seal is in its breathing hole, as this Harp Seal is, there is no chance of capturing it; the technique of sealing by helicopter is to surprise the seal well away from its hole.





Daniel Leblanc, John-Fred's father, explained their philosophy to me (in French); "Here we are poor, poor. But capable! So it balances." Possibly the world could do with a few more poor but capable people.

And M. Leblanc did not exaggerate! Paul and John and I made our base on the south side of Amherst Island at the home of the Lebel family, a place of great friendliness and capability, and of the most excellent food as well. Willie Lebel, the eldest son, was to help us on the seal hunt and in the crating of the seals which the helicopter would bring to the Lebel property for safe-keeping.

On March 17 we caught our first seals by a method so simple that it seems too easy in the telling. It depended upon the presence of the helicopter fleet, of course, and the coincidence of seals and helicopters is not an everyday occurrence. Paul and John and I were dropped out on the ice by the large helicopter, a Vertol, with the sealing crew under the direction of Alphonse. There was also present a small scouting helicopter, a Bell G-2, that we would be able to use for scouting a little later in the day, and some

One of the easiest captures was this one — a cow Hood Seal and her five-day-old pup found isolated on the ice. Both came to the Aquarium. The cow weighed 410 lbs., the pup 88 lbs.

larger Bell G-2As for hauling as well. But wishing to get started immediately, we loaded Paul's ice sled with nets and rope and canvas sacks especially for the bagging of the animals and made off for the nearest seals only a few yards distant. It was a warm day, and though we took along plenty of warm gear, sleeping bags and air mattresses, just in case, we could peel down to lumber shirts for work. On the ice, temperatures are deceptive. One moment you are warm, the next cold. The trick of staying comfortable is to avoid sweating or getting wet and this is a matter of experience. Once mastered, the ice is the most exhilarating place conceivable — walking over the clean crisp pack, inhaling an air so pure that New York is hardly imaginable, strolling unconcerned among perhaps a million seals.

The young in white coat are, of course, there for the taking, but we were after adults as well and these proved to be wary. We spent a bit of



The nets are large and strong and soft, made of cotton mesh, and they do not harm the seal when thrown over its body. Generally it rolls when the netting lands and thus entangles itself.

time waiting behind pressure ridges for an adult to wander from its hole in the ice. Then we would make a mad dash for it, but the seal always beat us back in. The ice holes were too numerous and too close. But we were able to make observations of the seals nursing and blowing and of other aspects of their behavior.

Alphonse and one of the pilots soon had their side of things well enough along to be able to come to our aid. With a net on Alphonse's lap, the helicopter rose 50 feet into the air and made immediately for a mother Harp and young about 150 yards away. We followed, panting, on foot with the sled. The helicopter hovered over an ice hole and almost appeared to nudge the mother seal, sliding down so as to force her away from the open water. Out Alphonse jumped, lowering his head away from the whirling blades, and almost immediately he had the mother at bay, not particularly frightened, but with mouth open and unable to get to the water. Just as we approached, he deftly tossed a bit of net to her mouth. She bit, then the rest of the net went over her body. She rolled and was hopelessly entangled. Just the right net had been brought by Paul and John for this job, 1-inch stretch mesh of cotton, soft so as not to harm the seal. John set about sewing the animal in its bag. The helicopter took off and had another seal in 15 minutes. That day we got three females and their pups, all fat and near the weaning stage, but still attractively in white coat. They were sewed in nets, placed in canvas bags with their heads near breathing holes and then placed on the helicopter's pontoons, noses to the rear so as

to prevent suffocation in the wind. That afternoon we had all six in excellent condition, without a scratch, back at the Lebel house. A little later, with the Lebels working at a furious pace, all were safe and sound in their own crates. The Lebel zoo had its start and persons came from all around to view it.

Several more seals were caught next day, including a male. Some were run down on foot and netted entirely by hand. All awaited on the ice, nicely bagged and unharmed — and then the weather played one of its tricks and the wind quite suddenly arose. All but two of the seals were freed, and we made hastily homeward in what looked like a rising gale.

But it was March 19 that crowned our trip. Hood Seals had been reported by pilots and sealers who had flown across a few isolated families on their way to the Harp Seal herd. Hoods are usually found scattered throughout somewhat looser ice, somewhat to the east of the main Harp herd. This time the Harp families were just south of the Madeleines, well within easy reach. Hoods do not herd up en masse as the Harps do, and the male, female and pup are usually to be found together in a group until the weaning of the pup. It was a very lucky break to find them so close, for this is one of the rarest of seals in captivity, the only ones being in the Quebec Aquarium.

On March 19 the sky broke clear, and John exclaimed "I hope it stays like this all day, face all burned up like the Harps. On a day like that you forget everything — forget to eat, forget to smoke, forget everything." Everyone, including

the bosses of the operation, led by Marc and Mme. Arsenault, piled into helicopters and we were off for the Hoods. Just south of Amherst there were two, a mother and a small pup. The helicopter with me was the first on the scene, luckily, after a short but eerily beautiful flight, all four helicopters in a row in the sun over the ice 100 feet below. We wheeled and set down a hundred yards away so as not to frighten the cow until the arrival of Alphonse, Willie and the net. Angelo Primo, Marc's assistant, and I scrambled over the ice to have a look. There was no water near the cow and she and her possibly five-day-old calf were prime individuals. These two had led sedentary lives since the arrival of the pup. However, the male was nowhere to be seen. The cow would not leave her pup, but she was a placid beast, not objecting much as we hauled her pup to a safe distance for her netting. Hoods are more stolid, though much bigger animals than Harps. This female weighed in at 410 at her arrival at the Aquarium a few days later and her pup weighed 88 pounds. The netting was gentle and she did not struggle as the helicopter lowered over her to pick her up in a sling load for transport to John, waiting at the Lebel's for the crating.

Less than an hour later we had all been transferred to the second Hood family, this time with the male "poche" present in all his 9-foot, 800-pound bulk. I did not arrive until after he had been netted, but according to Alphonse, he was heading for open water ponderously and there being no way to stop him, he had to be secured. Even he did not suffer a scratch. He put on a great display of inflating his hood, rearing up on hind quarters and then deflating slightly to have a look to see whether his adversaries were still present. There was plenty of time for everyone to photograph him at leisure. By night-fall, five Hood Seals, among the rarest of pinnipeds in captivity although not in nature, were on the Lebel's lawn.

I have occasionally seen men work furiously, but I can honestly say that never have I been present at such a seal-boxing. All the neighbors and the Lebels did not merely work and hammer nails; they ran and pounded and ran some more. The result was that a huge double-planked crate for the adult male Hood was constructed from



Gently lifted in its sling, a seal rides from its point of capture to the Lebel home in complete comfort and with the lapse of only a few minutes, for the 'copter travelled at 65 knots.

scratch in three hours, all eight Harps were re-boxed and two female Hoods and their pups were all safely put away for the trip homeward. And that trip began the next morning—a 950-mile truck and plane trip for our animals and, in Paul's case, a freight car load.

Now the Quebec Aquarium is the first in the world to exhibit a full family of Hood Seals and we follow with a female and her pup. We also share the distinction in being the first to show female Harps and their young. It is nice to have "firsts," of course, but the significant thing is to be able to call attention to these wonderful seals of the sub-Arctic ice so near home.



INCUBATOR BIRDS

By

JOHN WARHAM

WHEN EXPLORERS first returned to Europe from the Antipodes with tales of mammals that laid eggs, of Black Swans, and of birds whose eggs were buried in mounds of vegetable debris to be hatched reptile-fashion, they were often roundly abused for their pains. Many men of science refused to believe in such impossible creatures.

Well, time proved the explorers correct and in due course no less than 13 birds whose eggs are incubated in sun- or volcano-heated ground or by the heat of fermentation were discovered. They belong to the family Megapodiidae and inhabit Australia and New Guinea and island groups in the western Pacific.

The most widespread of these "incubator birds" is the Scrub Fowl (*Megapodius freycinet*). Imagine a neat, bantam-sized bird, golden brown

above and with a perky topknot on the back of its head. Like other members of its family, the Jungle Fowl has powerful legs and claws used for scratching among leaf litter for the insects, worms, and seeds which it eats.

Although it is the smallest of the Megapodes, the Scrub Fowl builds the biggest mound. Most would not fit into the average-sized dining room and many are 25 feet around and 10 feet high. One in northern Australia measured a few years ago was 60 feet long and 10 feet high, the result of many years' use, the birds having persistently raked new material on one side so that the pile had grown outwards to form a ridge. Presumably this mound is still growing today.

In my experience, Scrub Fowl are rather timid and usually walk sedately but quickly into the scrub when disturbed. One year I pitched a blind by a mound before the start of the rainy season. About three months later when I returned it was to find that every scrap of débris, every leaf and twig from the forest floor for yards around, had been raked onto the mound. The birds had worked right to the walls of the blind and the whole area could not have been cleaner had it

been swept with a broom. The only untidy place was the interior of the blind, which was choked with débris and disgorged a horde of mosquitos when I peered within.

I concealed myself before daylight — taking the precaution of spraying the blind thoroughly beforehand with insecticide. The rainy season had not ended and the crowns of the giant trees reached high into the mist, sending a steady drip of moisture from their canopies to thud onto my canvas roof. The Scrub Fowl announced their arrival at daybreak with soft grunting calls. They fossicked about on the edges of the mound and, working with each leg in turn, raked backwards with their claws. When I saw how much energy they put into this activity, how their bodies swayed and see-sawed as their feet pounded away, I could see easily enough how it was that they could build such gigantic incubators for their eggs. Usually a pair turned up. I could not determine their sex but I noticed that one bird did more digging in the center of the mound than the other and presumed that this was the male. The eggs — 12-15 are laid in a season — are deposited at the end of burrows dug into the warm heart of the mound, but which sex is responsible for this part of the work is not known.

Indeed, we know very little about this species, but what has been discovered is rather intriguing. The Scrub Fowl shows an amazing ability to

Left — Mallee Fowl are about the size of Guinea Fowl and take their name from the bushy eucalyptus trees among which they live. Below — The hen lays 15 to 24 eggs within a deep sand-and-leaf mound.

All photographs by the author





take advantage of natural heat of various kinds. Thus, while most of them build mounds of decaying vegetation, others in more arid habitats work quite differently. In parts of the Solomon Islands, for instance, ornithologist Charles Sibley of Cornell University has described how Jungle Fowl lay their eggs in burrows dug in the walls of a hot volcano and how, on a nearby island, the same species lays in shafts excavated in beach sands where the eggs must hatch simply through the influence of the sun's rays. A mound that I saw on a coral island of the Great Barrier Reef seemed to be composed entirely of pumice fragments. Unfortunately there was no time to excavate to find out whether there was any vegetable matter at its core or whether here, too, reliance was being placed on solar heat.

A much bigger Megapode is the Brush Turkey (*Alectura lathami*), a bird that has often been kept in captivity. Areas of pink skin on the face and yellow wattle-like patches on the throat con-

Scrub Fowl have an amazing ability to take advantage of natural heat. Their mounds are built deep in the forest and the heat comes from fermenting of vegetable material in them.

trast with the blackish plumage of this eastern Australian species. It is not restricted to the wetter forests and in parts of Queensland Brush Turkeys are quite plentiful in comparatively dry country, provided that there are patches of scrub to give adequate shade. This bird does not build large mounds — they are seldom more than three feet high — and many unused or old mounds are seen. The birds are not scarce; indeed, in Queensland they are still shot for the pot during an open season. A new mound is thrown up each year and several seasons elapse before the old ones finally disappear.

Leipoa ocellata, the Mallee Fowl, differs from the other incubator birds in being adapted to life in the sandy inland of southern Australia with

about 15 inches of rain annually and little surface water. The country is generally hot by day and cold by night and the dominant vegetation consists of low, bushy eucalyptus trees termed "mallees," with various heathy shrubs and acacias as an under-story. Here the Mallee Fowl lives on fallen seeds, on termites and other insects. When the scant rains fail and the seed harvest is poor, then the birds do not nest or they curtail their laying to a restricted period.

About the size of a Guinea Fowl and not unlike that bird in shape and bearing, the Mallee Fowl has a small head, prominent ear orifices, and large feet. The females lay directly into the warm bed of a mound of leaves and sand and 15 to 24 eggs are laid in a season. They are deposited at 5 to 9-day intervals, with the total period extending over three months. Laying to hatching takes about 62 days so that the first chicks may appear before the last eggs have been laid.

The Brush Turkey is one of the more familiar "incubator birds" and is frequently exhibited in the Bronx Zoo — where it builds its typical mound. These are seldom over 3 feet high.

Mound nesting may appear a primitive procedure but there is little of the primitive in the Mallee Fowl's ability to adjust its routine to changing weather conditions. On the contrary, the complexity of its nesting patterns suggests that it is really a very specialized bird. Just how specialized has been recently revealed as the result of researches undertaken by H. J. Frith of the Wildlife Survey Section of the Commonwealth of Australia's Scientific and Industrial Research Organisation (C.S.I.R.O.).

As apparently obtains with other incubator birds, the male Mallee Fowl undertakes the heaviest share of the nesting duties. He not only builds the mound but is mainly responsible for controlling its temperature. He starts off in the autumn by making a hole about 2 feet deep and 15 feet across. During the winter he rakes fallen leaves into the hole with his feet and since this is the wet season in these parts, by spring the pile of debris is thoroughly moistened. The mound is then covered with the surrounding sand.

Deep in the mound the vegetable matter decomposes, fermentation sets in and the temperature rises. Meanwhile the male guards the mound, and drives off any intruding Mallee



Fowl. When the internal temperature reaches 92°F., egg laying begins.

According to Mr. Frith, a female ready to lay walks onto the mound uttering a clucking note. At this signal her mate at once starts to dig out the center of the mound until he reaches the organic matter at its heart. He then moves to one side, allowing his mate to inspect the hole. This she does by probing with her beak. If conditions are right, she then scratches a small cavity in the side of the hole and squats down to eject her egg. The male watches all this silently but intently and hurries down from the edge of the nest as the female moves away. He covers the egg carefully and remakes the mound.

With the commencement of laying the male's duties become more demanding. It was once assumed that the birds' main problem was in getting enough heat to the eggs but the recent research shows that for all but about 15% of the time it is necessary to keep the temperature down. If the internal heat gets out of hand the eggs are cooked and killed; only the birds' attentions prevent this from happening.

At first, in the spring, the male digs out the center to just above the eggs each morning soon after daylight and so allows some of the heat generated overnight to escape. He then refills the hollow with cool sand. The eggs are not deliberately exposed and may never be seen again by either adult after their first covering by the male, nor are they turned around in the mound.

The male is no automaton. If a spell of cold weather arrives out of season, he does not excavate the mound but heaps the sand higher to retain the heat and to increase the insulation. By mid-summer a state of equilibrium tends to be reached, for although the fermentation heat has fallen the ground is hotter because of the higher day temperature, now reaching 100°F. in the shade. The male may now be able to relax a little and usually opens the mound only about once each week.

Towards the end of the summer when fermentation has ceased and the ambient temperature is also decreasing, the male adopts a new procedure; he makes direct use of solar heat. The mound is now opened daily but only after the sun is high enough to shine onto it. For most of the day the

mound and its few remaining eggs absorb the heat and then the male piles the sand high to retain the warmth overnight.

Obviously such a complicated system depends on the birds' ability to judge temperature and from the frequency with which they probe into the egg chamber it is thought that their thermometer lies in their mouths, probably in their tongues.

The effectiveness of the Mallee Fowl's technique was tested by building an exact replica of a natural mound and by comparing the heat changes within it against a similar control mound without debris and a natural mound in regular use. Soil thermographs were buried in each and charts of the temperature changes were made.

It was found that the temperature in the artificial mound rose rapidly through fermentation to 106°F. and remained there until mid-September, after which it fell steadily. In the natural mound the rise was more gradual and when the temperature reached 92°F. it was kept there by the birds' activities until mid-February when it too began to cool gradually. In the control mound the heat came solely from the sun; here the initial rise was much lower than in the other mounds but towards the end of the season, in February and March, the temperature was much the same as that of the other two. The graphs of the temperature changes show that

Display between Mallee Fowl is "a startling performance," for the birds — usually quiet and self-effacing — suddenly call attention to themselves by their postures and movements. Displays are brief.

the birds do manage to dissipate a considerable quantity of heat during the first stage of the incubation period and that after the time of mid-summer equilibrium, their actions in opening up the mound during the heat of the day tend to redress the lack of internal heat and the general cooling down on the ground as a whole.

That the Mallee Fowl is able to adjust to the needs of the moment was neatly demonstrated by Mr. Frith in a series of experiments with a mound fitted with electrical heaters so that its internal temperature could be boosted at will. When the heat was turned on the birds promptly took action to get rid of the surplus. Thus, if the



heaters were used in the autumn when the incubator birds were normally trying to let heat in, they at once reverted to their behavior of the spring, digging out the center in the early morning to permit the heat to escape.

My Mallee Fowl watching was mainly done in February when the season was well advanced. The birds were easy to watch and on arriving near the mound they would wander quietly among the bushes, often pausing beside the blind to preen themselves. They seemed reluctant to start the day's work.

I never saw an egg laid but I was lucky enough to witness the birds in display on several occa-

sions. This was a startling performance. With one Mallee Fowl on the mound, the other suddenly rushed up from behind the bushes. Its crown feathers were raised to a crest, the tail fanned, and the wings outspread and tilted forward. The transition from a quiet, self-effacing bird to an ostentatious creature in an heraldic posture, full of movement, was very dramatic. The other at once adopted a similar posture and the two circled round with their wings and tails tilted towards each other.

With mated pairs such performances were brief for it seems that this display is a form of threat, used mainly by the male, who is some-



thing of an autocrat when discouraging intruders. Mr. Frith gives an interesting example of this autocracy. One summer morning both birds started to open up the mound in readiness to lay an egg. Then a thick band of clouds suddenly blotted out the sun. The male at once rushed at his mate and drove her off, then replaced the soil they had shifted with so much labor. Did the male realize that if the storm broke while the mound was open the cool rain could damage the eggs? It would certainly seem so.

There is nothing labor saving in mound nesting. The daily opening and closing processes involve a tremendous expenditure of energy and in hot weather the birds become very distressed, pant vigorously and lose condition. For the male it is work, work and more work — after the last egg has hatched only about a month remains before he must start preparations for the new season.

Observations at an artificially heated mound with a glass side show that the chicks take several hours to reach the surface. With their heads in fresh air they lie exhausted, then struggle out and make for the shelter of the nearest bush.

Monitor Lizards (Varanus) are natural enemies of the Megapodes, finding it easy to dig out and devour their eggs. The introduced European Fox is an even more dangerous predator.

The parents take no notice of them at all. Even if the chicks are accidentally dug out of the mound during temperature-control operations, they are ignored.

As may be imagined, such young birds are very vulnerable. Many die in hot weather through suffocation as they try to wriggle free. Predation of the eggs is also high, the natural enemy being a large monitor lizard which digs out the eggs. Even more serious are the attentions of the European foxes which eat the eggs of the Mallee Fowl and sometimes those of the Jungle Fowl too. Fortunately, foxes are absent from the rain forests but the Jungle Fowl is eaten by some of the natives on the Pacific Islands. In certain districts the local inhabitants even go so far as to prepare shafts in volcanically heated soils to encourage the Jungle Fowls to lay and from which the eggs can be removed with a minimum of trouble!

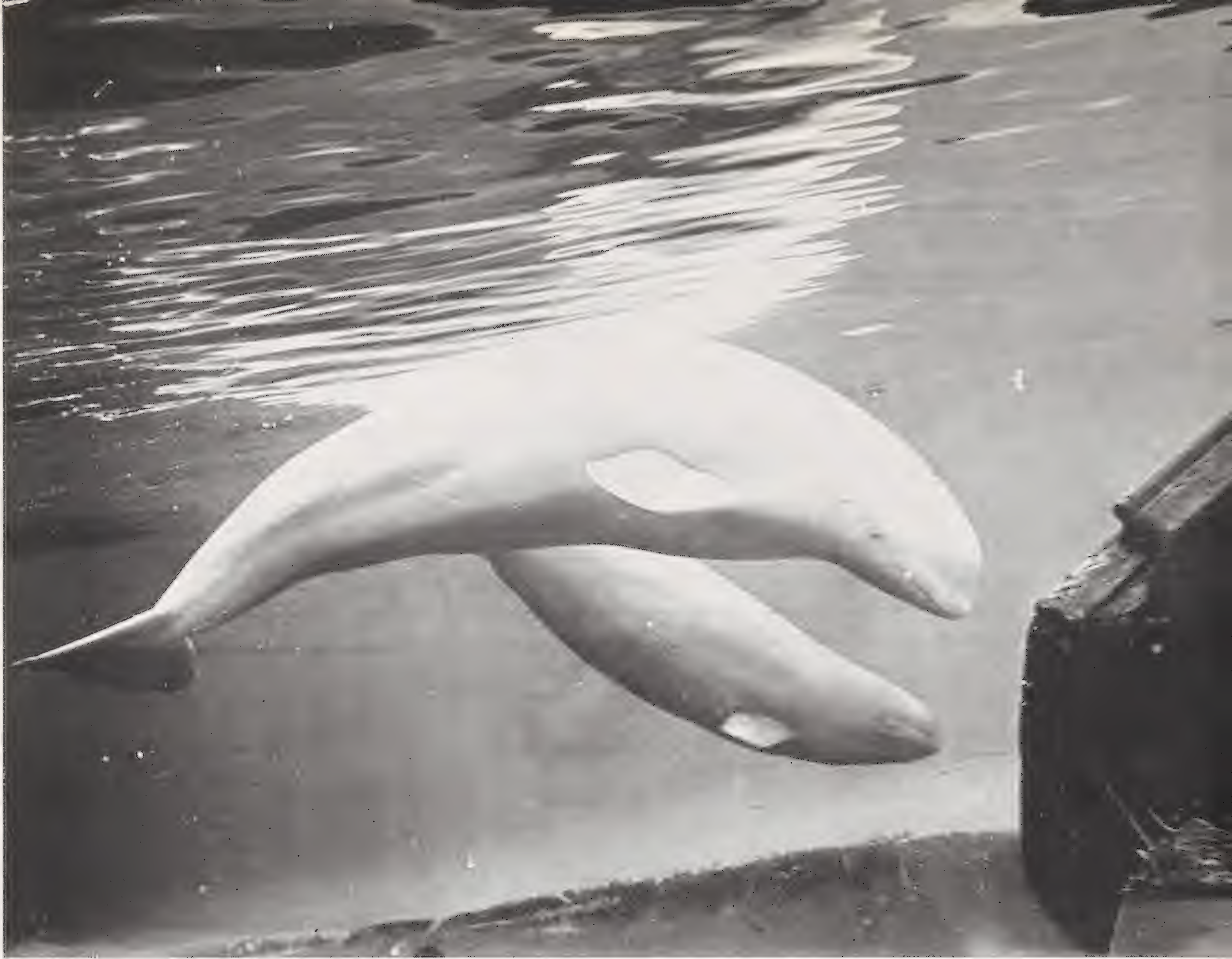
ZOO NEWS IN PICTURES

Photographs by SAM DUNTON

Staff Photographer

Many birds are rare in captivity; a few, unfortunately, are rare in the wild. Among these is the Nene, or Hawaiian Goose — probably the rarest species of waterfowl in the world. Only about 300 specimens are known, most of them in captivity. This handsome pair came to us at the end of May from Peter Scott, director of the Wildfowl Trust in England, and adapted immediately to life on our Marsh Garden pond where conditions are excellent for breeding. In 1950 there were only 17 Nenes known in the wild, and 17 in captivity, but they are increasing under artificial rearing projects in Hawaii and in England — in fact, in recent years, a few captive-bred birds have reinforced the wild population.





Undoubted star of the big Oceanic Tank at the Aquarium is a 10½ ft., 950 lb. Beluga, or White Whale, that came to us on June 19 from the St. Lawrence. Many years ago whale weirs were built at the Ile aux Coudres to capture Belugas for oil and this spring another one was built for use in a documentary film. Soon thereafter our Beluga swam in and was caught — the first in 35 years.

Photograph by Nat Fein—New York Herald Tribune



When this little Japanese Macaque was born on June 28, its father and mother apparently decided it was an interesting toy — perhaps a rag doll. In any event, they treated it as one until it was rescued by a keeper and removed from the compartment. Keepers and members of the staff “mothered” the baby for the next two weeks until it was turned over to the Animal Nursery. Here Grace Davall is giving it one of its two-hour bottle-feedings.



High-spirited antics are not, somehow, quite what one expects from a Dromedary — even a young one. And yet that is what we have been getting from “Surprise,” the baby born on April 10, as he accompanies his mother around the corral. His mother is sedate enough as she is being trained to lead, in preparation for a career on the Riding Track. But at any moment the baby is apt to dash off in a most ungainly fashion in any direction.



Baby animals now have a home of their own in the Zoo. On June 27 the Animal Nursery was opened, adjacent to the Children's Zoo, and its first residents (although they will change constantly) included “Mr. Moto,” a baby Japanese Macaque, a young Palm Civet, a family of eight Ferrets, a juvenile Screech Owl, a peachick and assorted ducklings. Miss Alice Tully gave the greater part of the funds for the construction of this attractive and novel installation.



5,000 BUGS--



A YEAR'S WORK WOULD FIT IN A TEASPOON

By M. G. EMSLEY

William Beebe Tropical Research Station

in width. Unfortunately we also have to include such pests as capsids, aphids and bedbugs.

It is a truism that in biology the distribution of small or so called "rare" groups most usually reflects the distribution of their collectors. Thus, fifty years ago this family was thought to be mainly Central American because E. A. Schwarz and H. G. Barber were virtually the only people who had found them. Since then they have been taken from over the whole tropical and subtropical world, even including such remote islands as Hawaii, Seychelles, New Caledonia and Guam.

Serious collecting was begun in Trinidad in January of last year and in that year some forty-five species were collected, of which forty-four are new to science. Of these, thirty-eight were taken within one hundred paces of the Simla laboratory! It is likely that the Simla list is fairly complete now, for no new species have been added to it in the last few months, but thirty-eight new species, including two new genera, is a list of which Simla may be justly proud. How many species would Dr. Beebe have taken if he had collected bugs of this size? For one must point out that one of these insects exceeding one-twelfth of an inch in length would be considered a giant, and many are less than a millimeter, that is, about the size of a printed period on this page. In fact, the 5,000-odd specimens collected in 1961

DR. WILLIAM BEEBE in "Jungle Peace" described how he examined a square yard of tropical forest floor and counted the animals living in the surface litter and top few inches of soil. The conditions under which he was working forced him to disregard the smallest species, for their collection takes a long time and identifications by the field zoologist are most difficult, if not in many cases impossible, but even so Dr. Beebe estimated that a square yard of jungle contained not less than a thousand organisms plainly visible to the eye.

At Simla, the Tropical Research Station of the Zoological Society in Trinidad, during the last year or so we have been studying a small group of bugs which live in soil, forest litter, ants' nests and doubtless other rather specialized habitats. They are members of the family Schizopteridae in the order Hemiptera, an order of true bugs that proudly sports such well known insects as stink bugs, cicadas, spittle bugs and the giant water bugs which are among the largest insects known — over 4 inches in length and 1½ inches

would comfortably fit into an ordinary teaspoon.

Though small, when seen through a microscope these bugs are truly exquisite, having brilliant crimson eyes like raspberries, and many having wings that are deeply sculptured. They also display many bizarre features whose function is quite unknown; in fact their biology is shrouded in mystery, for not only do we not know what they feed on, but in many cases their habitat is not known, either. "How, then," you may ask, "do you catch them?"

By far the most successful method of locating specimens capable of flight is the use of light traps, and it is principally by this means that our species list has been made. These traps were designed to be cheap, easy to transport yet efficient at catching insects, and to fulfill these requirements we made units such as the one illustrated on this page. Each day a solution of household detergent in water is put in the bowl and during the night the insects fly to the light and eventually touch the water, whereupon they sink and cannot escape. Were it not for the detergent, small insects could alight upon the water and take off again and escape in the morning when the lamp loses its power of attraction.

There is one unpleasant aspect of this kind of collecting, however, for if the trappings are stored for a few days and later examined, the smell is for a few minutes absolutely nauseating. But one's nose does become fatigued, and only visitors are sick.

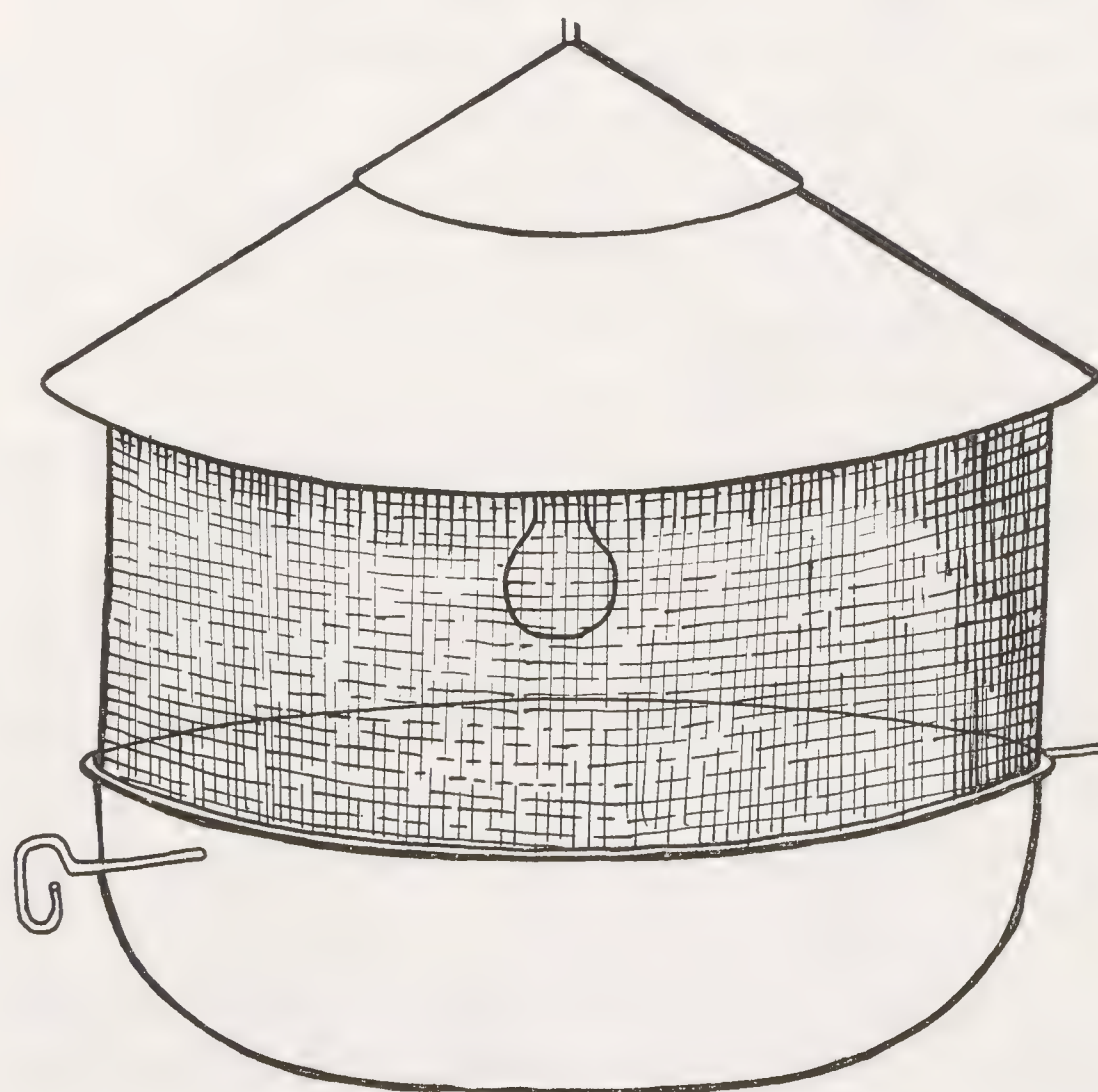
The quarter-inch wire mesh was selected to exclude the larger insects, particularly moths whose scales become detached and make the process of sorting much more troublesome, but it does not exclude schizopterids and other small insects in which we are interested. The container is a locally purchased aluminium wash bowl secured by a wire pin passing through it and the bottom edge of the mesh. The electric fittings at the top were waterproofed by a piece of automobile inner tube cut to form a cone and stuck to the electric cable with waterproof adhesive. The total cost of the traps, using our own labor, was \$2.50 each.

Picking out schizopterids from the trap is a task closely akin to looking for a needle in a haystack, for in the rain-forest hoards of insects are attracted to a bright light, making the night's

catch look like a thick insect "soup" — and not an appetizing one, either. In this soup, on a "good" night (we are still trying to find out what makes a "good" night good), we may find up to nine or ten schizopterids but a more usual score is two. This presumably means that with the exception of one species either they are comparatively rare insects or they do not find light very attractive. My kind of light, at any rate.

Having discovered that the Simla fauna was very rich, the next task was to find where the insects lived. Sweeping and beating foliage brought forth only one specimen and that of a species not taken at the light. To test the altitude at which they were living, in case they lived in epiphytes, moss or lichens high in the forest canopy, light traps were suspended on ropes from branches of trees at levels between the ground and fifty feet, and each day the traps were hauled down and emptied and the catch sorted out, a process that took twenty man hours per day. We found that although schizopterids were capable of flying to a height of fifty feet, no species were taken in the high traps that were not more common in the traps at ground level. So the search was concentrated on dead leaves and other vegetable detritus that accumulates on the forest floor.

Samples of litter from what seemed different types of habitat were collected and sieved through a 2 mm. sieve over an illuminated sheet of white paper. Then the sievings were carefully studied and moving objects identified. Luckily, Schiz-



opteridae have an easily recognizable pattern of movement but unluckily they are liable to jump up to a couple of inches without warning, so that capturing the specimen, once it has been spotted, can be very frustrating. A schizopterid is so like a grain of soil that in sifted material, if it remains stationary, it is completely safe. Through the kindness of Jocelyn Crane, litter samples were brought back from as far away as Singapore and the Philippine Islands, but unfortunately, owing to the strict customs regulations concerning the transportation of soil and living insect material, by the time the samples arrived any schizopterids they might have contained were long since dead and therefore rendered invisible. So far only a dozen species have been found in litter. Where the other thirty-three live is still a mystery, but the investigation of ant nests may prove profitable.

In the accumulated data from the light traps one particularly interesting feature has emerged. There is one species at Simla — and only one — the males of which fly to light in vast numbers. The maximum so far for a single night is 1,276, and when tested at hourly intervals it was found that they fly only immediately after heavy rain; they do not fly on a night when there is no rain at all, nor when it rains non-stop. The best conditions are produced on a night which has a series of short heavy showers, followed by an hour or so of no rain, and the best period of the night is following a shower just after dusk. The reason for this swarming is not known, nor do we know what triggers it off. Indeed, until the work started at Simla, it was not even known that the insects swarmed at all. We have amassed a great deal of data concerning temperature, humidity and rainfall, and since some of our larger catches seem to have coincided with a full moon we have been led to consider lunar influence, too.

This can hardly be a mating flight, as is common in termites, because only the males can fly, the females being wingless, and for the same reason neither can it be a migratory or distributional flight. We plan to use a garden sprinkler to simulate rain — which we hope will promote a flight artificially and bring us a few steps nearer the solution to the problem.

Sieving, though producing relatively few species, has enabled us to observe living insects in

the laboratory and attempts have been made to discover their feeding habits and life history. For laboratory experiments cages were made by casting plaster of paris blocks one inch square with a depression half an inch in diameter and one-quarter of an inch deep drilled out of one face. This face was then ground flat. The blocks are embedded in damp moss and the schizopterid is persuaded to jump into the recess, whereupon a microscope slide coverglass is laid on top and the bug is then accommodated in a Lilliputian house with a glass roof. Though none have been observed to feed upon the variety of foods offered, the structure of the mouth parts suggests that some may be predatory and others plant feeders. Provided the moss is kept damp they frequently survive a month or more in the cages and the females may even lay eggs. Incidentally the eggs are very large in proportion to the body and a gravid female can only carry one or exceptionally two at a time. In order to lay sufficient eggs for at least two of her offspring to reach maturity, and thus ensure the continuation of her race, the egg-laying period must be spread over quite a long time, and in fact gravid females can be found all the year 'round. Oviposition is assisted by the hind legs, which push the egg from behind by pressing on the lower surface of the abdomen.

Though males and females of what appear to be similar species have been caged together, neither mating nor even recognition has been observed. The male genitalia are interesting in that the principle structure is about three times as long as the total body length, and when at rest lies coiled up like the hairspring of a watch.

There are many interesting facets to the morphology and biology of these bugs — as there is to almost any little-known group — and this problem serves to show us that even in this enlightened decade there are still many groups of which we are profoundly ignorant. With much of modern medical and agricultural research now being directed at the tropics, it is becoming more and more important to understand the biology of soil organisms and the part they play in the structure of tropical soils. But our particular problem is to obtain material for a morphological study of the family and to attempt to place them systematically within the Order Hemiptera, for at the moment their affinities are purely speculative.

"Don't Get Saddled

with a Seahorse"

By JAMES W. ATZ
Curator, New York Aquarium



PEOPLE IN NEED OF INFORMATION about wild animals or fish naturally turn to the Zoological Park or the Aquarium for help. The number of telephone calls and letters we receive about any particular subject is therefore a good barometer of current public interest in it. When, a few years ago, the Aquarium was suddenly bombarded with questions about the care of seahorses, we knew that something new had happened to make people aware of the seahorse as a pet. We soon learned that an enterprising Florida concern was selling, for a few dollars, a kit containing two live seahorses and what was declared to be all the apparatus necessary to keep them in captivity. From long experience, we quickly realized that we were "in for it," for on us would fall the unpleasant duty of informing numerous well intentioned but misinformed peo-

ple that in order to expect any success in maintaining seahorses in their homes, they would have to spend a good deal more money and effort than the vast majority would ever be prepared to do.

The duty was made doubly unpleasant because we realized that to almost everyone seahorses are diminutive, harmless and charming creatures that evoke mixed feelings of amusement, wonder and even affection. In fact, after 25 years of association with public aquariums and the public, I am more certain than ever that the seahorse is the most popular of all fish, and I am sure other professional aquarists would agree with me. For years people have wanted to keep these captivating fish as pets — and for nearly as long as it has been in existence, the New York Aquarium has tried to discourage most would-be seahorse owners. Dr. Charles Haskins Townsend, who directed

the institution from 1902 to 1937, did so in its first guidebook, and his successor, Dr. Charles M. Breder, Jr., lent his authority to the effort. The Aquarium's present Director, Christopher W. Coates, has periodically attempted to educate the public on this score in his newspaper column on tropical fish and home aquaria, which has appeared each week in the *New York Sun* and the *New York World-Telegram and Sun* for the past 31 years.

The real purpose of all these publications, and countless letters, interviews and telephone calls as well, has been not to prevent people from keeping seahorses at home, but to make them aware of the equipment and know-how necessary to give the fish a reasonable chance of surviving. Seahorses require sea water and living food, and it is these two deceptively simple requirements that make them so difficult to keep.

Sea water is a complex substance that begins to deteriorate, as far as its ability to support marine life is concerned, practically as soon as it is removed from the sea. In order to slow down this deterioration, it is necessary to aerate the water more or less constantly and, even better, to circulate it, filter it and regularly store it for extended periods in the dark. When hardy creatures like seahorses are to be maintained, however, it is possible to get by with aeration alone. This calls for a small air-pump to force a continuous supply of air through a tube into a porous stone kept near the bottom of the tank and from which the air emerges as a rising stream of many small bubbles and thus aerates the water. It is even possible to use artificial sea water for seahorses, but this, too, requires aeration to prevent a dangerous build-up of poisonous carbon dioxide. Moreover, a marine aquarium must be kept scrupulously clean, for the least bit of decaying organic matter hastens the deterioration mentioned above. These are some of the reasons why the hobby of keeping marine fishes as pets has never rivaled its freshwater counterpart. Seahorses can never be as easy to maintain as goldfish or guppies, simply because they come from the sea. Experienced fish fanciers have long recognized this fact — and have dreamed of a *freshwater* seahorse. So far, despite recurring tales of seahorses inhabiting lakes and streams in the interior of Borneo and other remote places, a species of seahorse

from fresh waters has remained a dream. The idea is not entirely fanciful, however, because more than one species of freshwater pipefish is known, and pipefishes and seahorses are fairly closely related, both belonging to the same Family.

As marine fishes go, seahorses are one of the hardier and more adaptable varieties, except when it comes to feeding. In nature they feed on small crustaceans, those tiny relatives of the crab and lobster so aptly called the "insects of the sea," and very few seahorses ever learn to eat anything else. Unless an object is of the right size and is moving in the correct manner, they will ignore it. The problem of obtaining food for the seahorses used to be a serious one even for the largest public aquariums. At the old Aquarium in Battery Park, we had a collector who spent a good deal of his time searching along shore for *Gammarus* to feed our seahorses. Unfortunately, the supply of this small crustacean is seasonal, which made it almost impossible to exhibit seahorses the year 'round. In the early 1930s, however, it was discovered that the eggs of the common brine shrimp could be stored in a perfectly dry state for several years and then would hatch within two days after being put into salt water. This provided a practical way to culture seahorse food on the premises. Since brine shrimp eggs can be found by the millions around some brine ponds and salt lakes, they were soon being marketed at reasonable prices. In many ways, the brine shrimp has proved an ideal food for captive fish that demand small, living prey; both amateur and professional aquarists, for example, have been able to breed and rear seahorses on it alone. But a lot of brine shrimp are needed to satisfy a single seahorse, and in order to obtain viable hatches of good size, the water containing the eggs and larvae must be vigorously aerated.

The necessity for artificial aeration in the successful maintenance of captive seahorses, both for the seahorses themselves and to rear their food, brings us back to the seahorse kits which purport to provide the purchaser with everything necessary to keep the fish properly. Such kits do not include an air-pump or any sort of aerator. What they generally contain is two live seahorses in a plastic bag with a small amount of sea water, a vial of brine shrimp eggs, and a package of salts that will produce a rough approximation of sea

water when dissolved in a certain amount of water from the tap. An aquarium to hold the seahorses may or may not be included, but no containers in which to hatch the brine shrimp are ever provided. On the contrary, the purchaser is usually instructed periodically to dump some shrimp eggs into the aquarium with the fish, a practice that soon leads to an unsightly and unhealthy accumulation of egg shells and unhatched eggs.

The kits have additional shortcomings. If they supply an aquarium, it is too small, especially with no artificial aeration; if they do not, the advertisements describing them imply that a goldfish bowl would be adequate, which it definitely would not. The artificial sea water is usually of an inferior quality, and not enough of it is provided, in any event. Finally, the instructions accompanying the kits are far from adequate.

With all these handicaps, in addition to the legitimate difficulties that experienced and well equipped amateur aquarists have in keeping any kind of marine fish, it would be expected that extremely few owners of seahorse kits would obtain any satisfaction from them.

A further complication was added by the particular species of seahorse that the dealer decided to use, namely the Dwarf Seahorse (*Hippocampus zosterae*). This tiny fish, which may be a little less than an inch long when adult and which never exceeds two inches, adapts well to aquarium life and might seem to have been a good choice, but its natural life span is hardly more than a year and is usually less. Dr. Kirk Strawn made an extensive study of this species and found that the Dwarf Seahorse attains maturity when only two or three months old and that few individuals live to be one year old. No one will ever know how many unlucky purchasers of seahorse kits received specimens that were near the end of their normally short span of life.

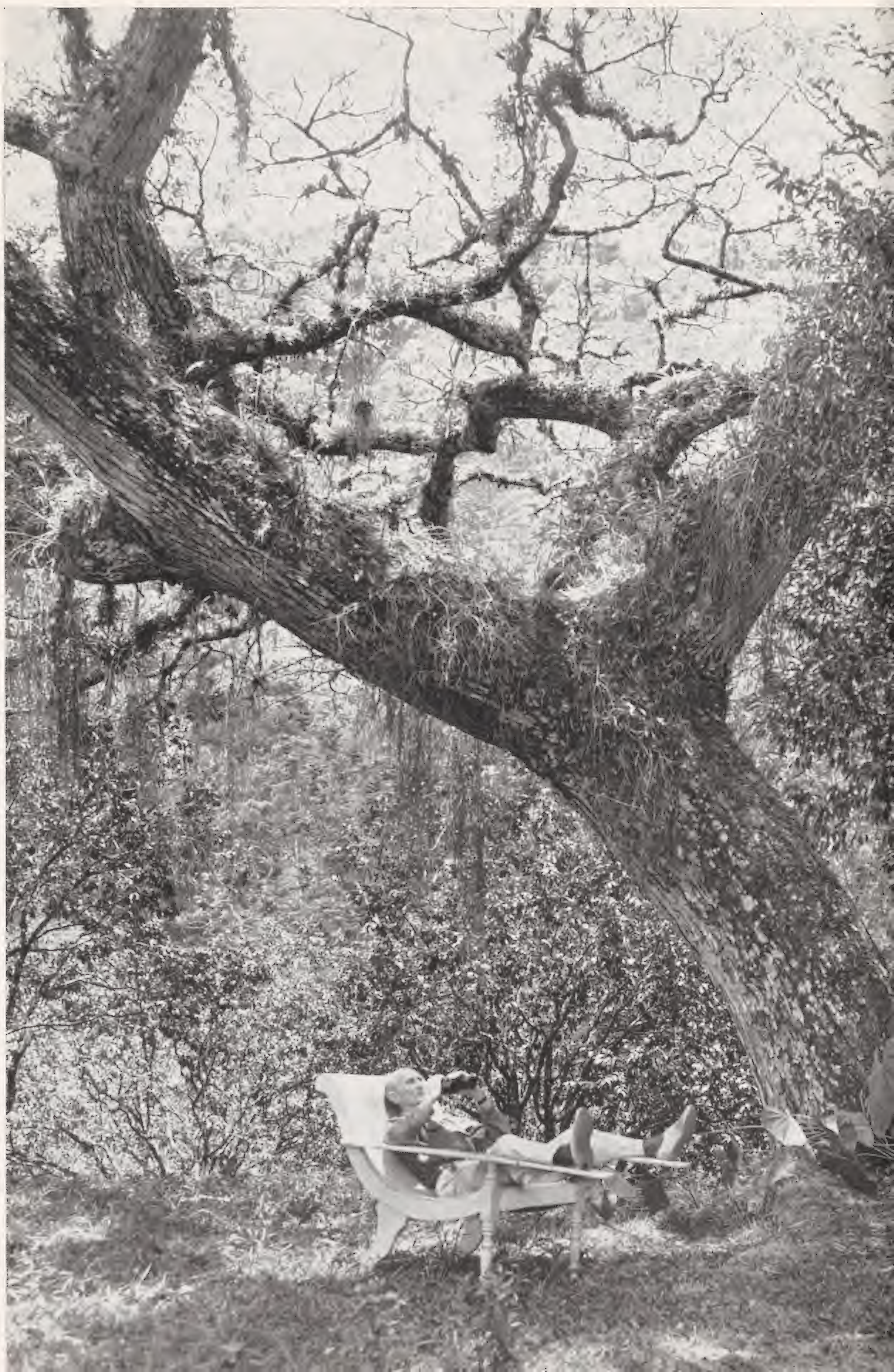
Early this year a welcome opportunity to take action against this waste of seahorses and misleading of the public came to us through the National Better Business Bureau of New York City. As a result of our collaboration, the Bureau published, in May, a *Service Bulletin* (Periodical No. 1784) in which it recommended more realistic advertising by the firms — there were at least three of them now — selling seahorses. The prin-

cipal part of the *Bulletin* consisted of extracts from a long letter I had written covering the points I have made in the present article. The *Bulletin* also reproduced Director Coates' most recent Tropical Fish column dealing with the same subject, to which an inspired copy editor of *The New York World-Telegram and Sun* had given the succinct heading: Don't Get Saddled With a Seahorse. We have, of course, no way of knowing how effective our various crusading efforts, including this one, may be. At any rate, I was reassured to learn recently from Dr. Strawn that in spite of all the depredations of collectors, there is no danger at present of exterminating the Dwarf Seahorse, even on the collectors' favorite grounds. Nevertheless, any waste of wildlife ought to be discouraged and halted if possible. This minor crusade of ours is not yet finished.

One of the ways in which we try to help people with their seahorses is to give them a list of up-to-date, authoritative articles and pamphlets on the care of the seahorse in captivity. In the expectation that readers of *Animal Kingdom* might be interested in keeping these fish (in spite of the present article!), we are appending this useful list.

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William Beebe: 1877-1962

By FAIRFIELD OSBORN

President of the New York Zoological Society

THIS SPELLS THE END OF AN ERA," was the spontaneous exclamation of several people at the news of the death of William Beebe on June 4. It was no doubt the reaction of many others at learning of the passing of this remarkable man.

William Beebe was unique in his personality, in his gifts and in his accomplishments. In the contemporary period, stretching back to the early years of the present century when he started his career, all the pressures upon a scientist were towards specialized fields of work. He, of course, was fully conscious of this but his interests were so universal and he himself was so independent in character that he disregarded the trends that were influencing the work of other scientists and naturalists.

He initially made his name as an ornithologist and when only 28 years of age published his first book, "Two Bird Lovers in Mexico." This was followed by "The Bird — Its Form and Function," and some years later by the remarkable four-volume "Monograph of the Pheasants." The preparation of this monograph required almost two years of arduous travel in China, northern India, Indo-China and the Malay peninsula. Its publication immediately marked him as a person with unusual powers of observation as well as rare capacities for descriptive writing.

Had he so wished, he could well have gone on for the rest of his life building upon the career as a competent ornithologist he had so rapidly established for himself. Such a course of action was, however, not within his nature. His interests in the natural world were unbounded, not specialized, so he turned to studies of life in the tropics, not birds alone but all forms of living creatures and their environment. In a sense he became a

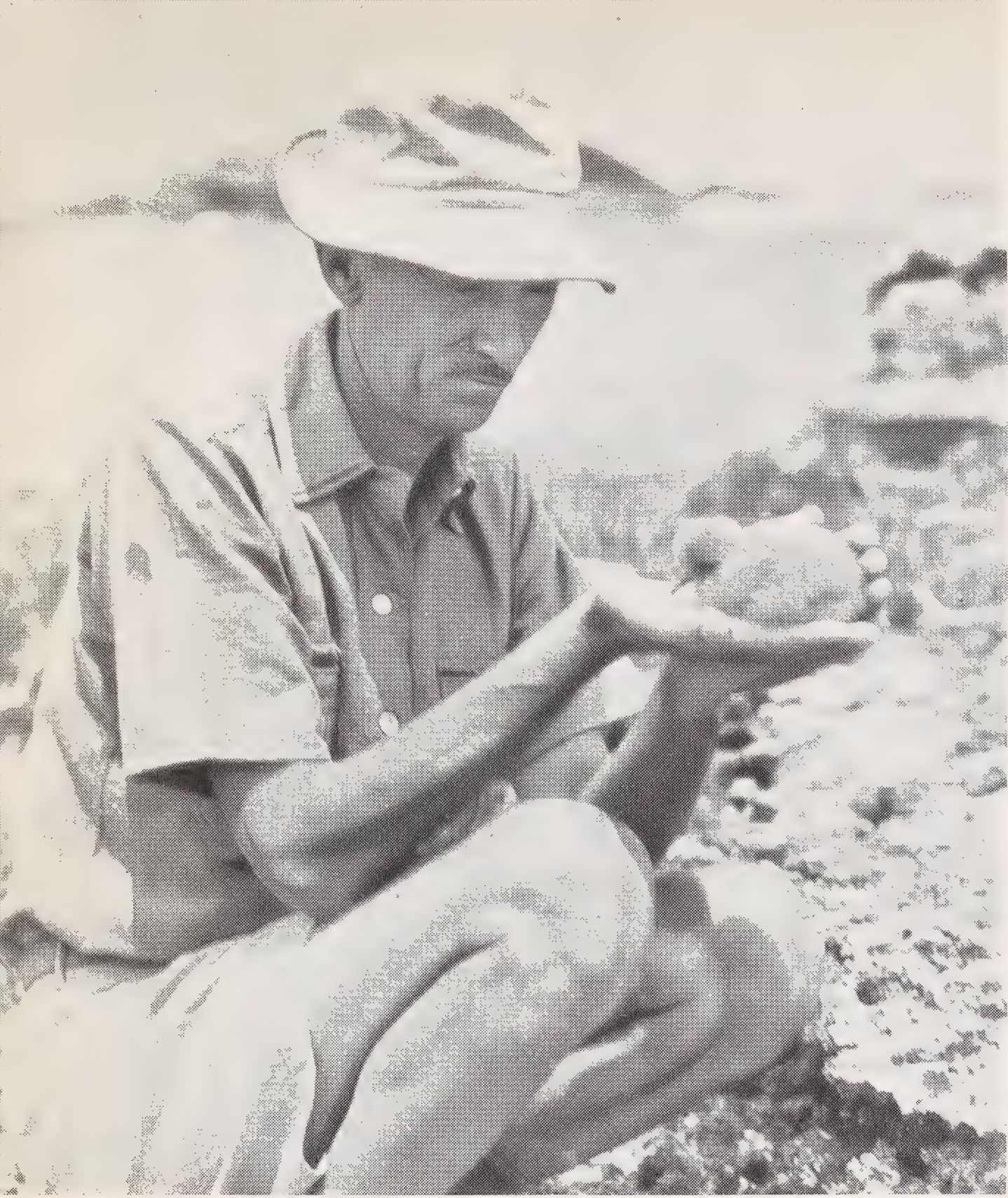
pioneer in the science of ecology, a science that has attained ever increasing importance in subsequent years. He proposed that the Zoological Society should establish a station at Kalacoon in British Guiana. This was done in 1916 and most of the next 8 years were spent there. He planned that the work at the station should be based upon an unusual concept, namely that ultimate knowledge could best come from intensive study of life in a limited area rather than through wide-ranging field trips. Consequently, throughout these years, the activities of the station focussed on an area no larger than a half mile in any direction. From these years in the tropics stemmed several of his greatest books, including "Jungle Peace" and "Edge of the Jungle."

His searching mind and spirit sought then for greater understanding of life within the oceans. This compulsion led to a series of voyages such as those to the Sargasso Sea, the Galapagos, to the eastern littoral of the tropical Pacific, and then to the establishment of the Society's marine research station in Bermuda where he and his staff worked for 13 years. From these experiences flowed still another series of books such as "The Arcturus Adventure," "Galapagos: World's End," "Book of Bays" and "Half Mile Down."

An incident comes to mind concerning this man's thirst to observe every element in the natural world. While visiting with him in Bermuda in 1937, I happened to go to a dinner party with some friends. When I returned to the Biological Station, where we were both staying, at an hour well after midnight, the light in William Beebe's room was still burning. He heard my footsteps and rushed out into the hall and led me quickly to an upper porch where he had placed a powerful telescope. "I could not go to sleep," he said, "until you had seen this wonderful sight in the night skies. Look, there is Finsler's Comet — it is just making its appearance."

He was greatly motivated by seeking adventure and risks. He used his lithe, wiry body as a

This photograph of Dr. Beebe "bird watching" from a Barbice chair under a giant saman tree in Trinidad, was made ten years ago this spring. Earlier he had climbed the tree for a scene in a movie about Simla.



Thirty years ago Dr. Beebe wrote in "Nonsuch: Land of Water" about finding the almost extinct Bermuda Cahow nesting on tiny Idol Island. He is here holding a rare Cahow chick.

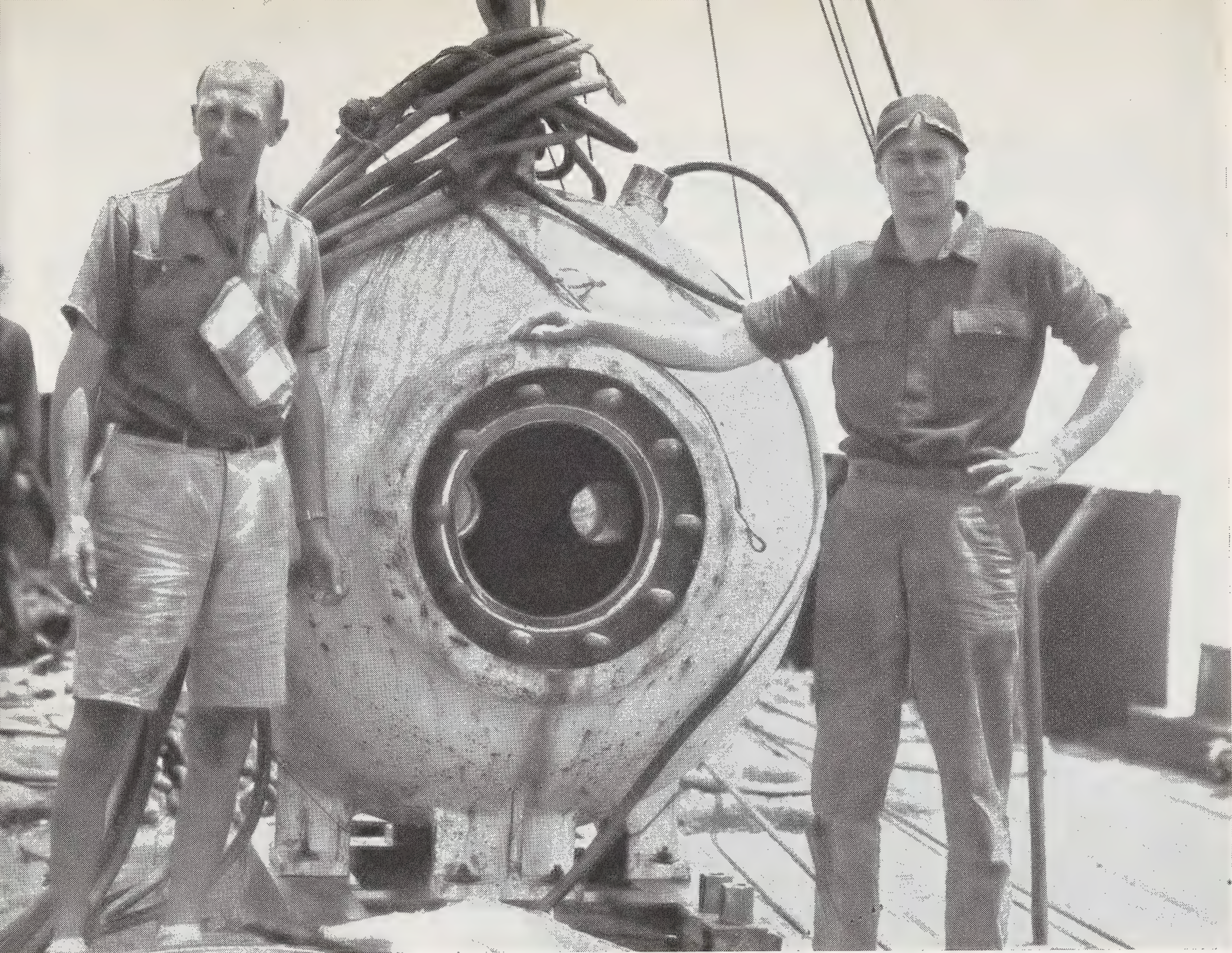
high-speed vehicle for driving through life and work. He thought of himself, I suspect, as a sort of tireless machine. His thirst for adventure contributed to his immediate acceptance of the proposal made by Otis Barton, who had designed a new vehicle for diving into the ocean depths. The excitement of this plan appealed to Beebe enormously, quite apart from his desire to explore what might be discovered concerning ocean life at a great depth. In those days such a descent assumed almost the excitement of an orbital flight today. The greatest previous descent in all history was merely 525 feet. Beebe and Barton were determined to make a descent of a half-mile or more. Its dramatic appeal was immense and after the successful descent to 3,028 feet, the name of "Beebe" assumed a new connotation throughout the world. Although, as he realized, the scientific consequences of this descent might not prove of large importance, he had at least gotten himself into a new element on this planet.

The ultimate period of his life's work then

evolved as if by predestination. After some 17 years of interrogation and study of marine life he returned to his first love — the life of a tropical region — first at Rancho Grande in Venezuela and then finally the island of Trinidad. In Trinidad he found what he considered a paradise — a forested, remote, mountain valley with a rich and varied fauna. This became the final field station of the Zoological Society under his leadership and there he worked for the last 14 years of his life. It was called "Simla," a name that evoked memories of Rudyard Kipling, an author whom he had always especially admired. And there he died.

A little-known incident should be revealed here. William Beebe had an overriding devotion to his mother-institution. He thought of the Zoological Society as one might of a parent to whom some special loyalty was owed. Quite often he would remark about some phase of his work, "I think this will be a credit to the Society." But he went further. His books, articles and lectures had brought him considerable financial returns and from these he purchased the property for the department's Bermuda laboratories. Later, with the proceeds of the sale of this property, he acquired the land and buildings in Trinidad. A few years ago he made a gift to the Society of this valuable property in whose possession it now lies. Having started life with no means of his own, this was the culminating act in a sequence of contributions he had made from his personal earnings towards the development of the Society's work. His name appears in our roster as a Benefactor. William Beebe was unique in more ways than one.

It is never possible to trace the source of an unusual talent such as Beebe's literary gift. He had a high school education and three years of biological courses at Columbia University. Yet he wrote with rare skill and his books had universal appeal, a number being translated into a dozen or more foreign languages. He himself accounted for this to some extent by a chance conversation he had with Theodore Roosevelt, who throughout Beebe's life remained one of his idols. Mr. Roosevelt, keenly interested in exploration himself, asked Beebe to come and tell him of his experiences on the Asiatic expedition which resulted in the "Monograph of the Pheasants." Evidently Beebe's report excited and deeply interested Mr.



Dr. Beebe and Otis Barton standing beside the Bathysphere just after surfacing from a dive to 1,426 feet on June 6, 1930, off Bermuda. In 1934 they went to a maximum of 3,028 feet.

Roosevelt. Later Beebe sent him a written account, which Mr. Roosevelt criticized quite bluntly, saying, "What you told me was far more interesting than what you have written. You ought to write the way you talk." Beebe stated more than once this is just what he thereafter endeavored to do.

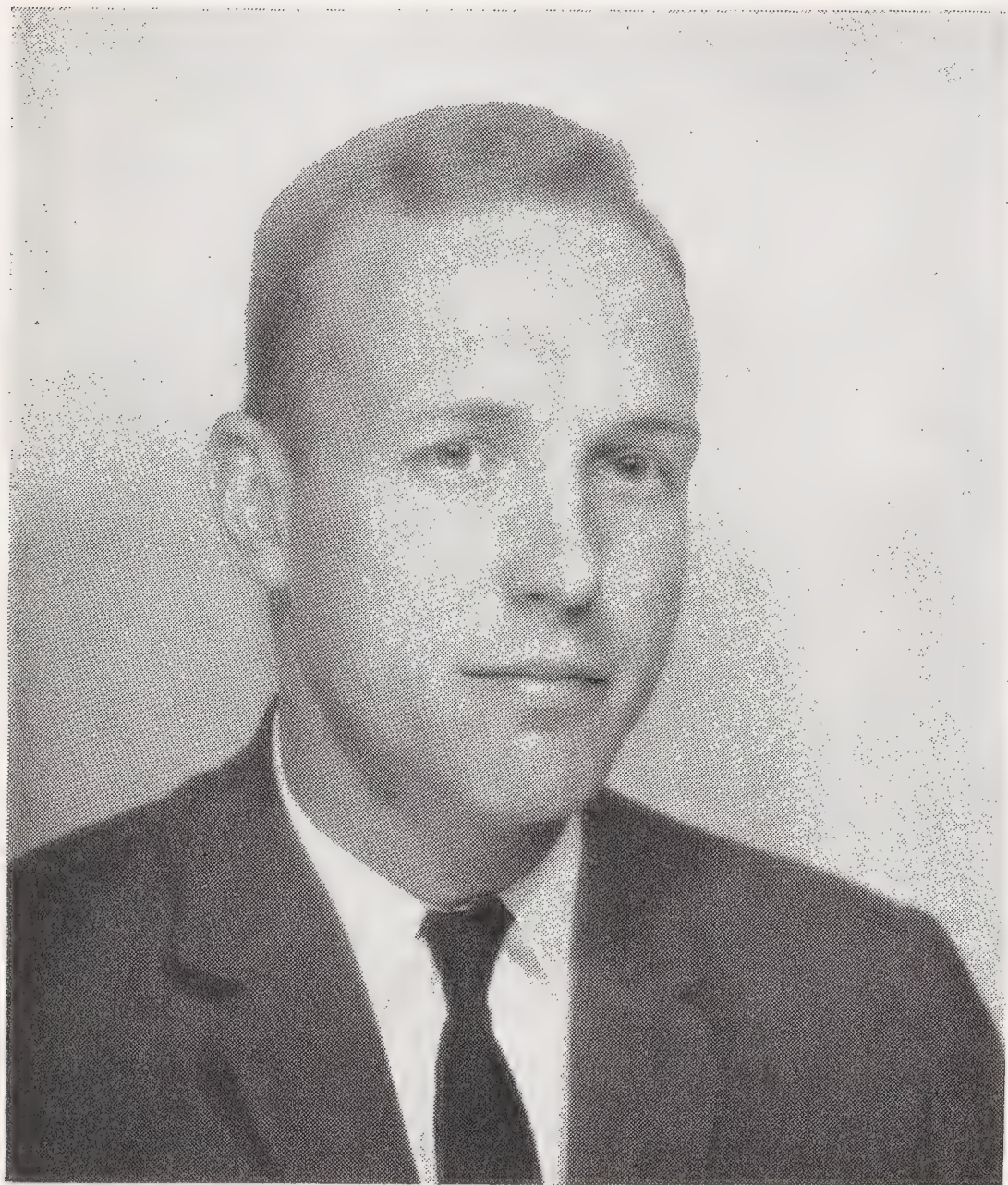
Another incident throws light upon Beebe's idea of what an author must try to accomplish. A friend of his had gone to Europe just after the last World War and had written an article on the devastation witnessed there. When Beebe was asked his opinion of this article he remarked, "You have only recorded what you saw. There is nothing new in this because the newspapers and magazines have for months been full of reports and pictures of these scenes. What any reader is especially interested in is what effect these experiences had upon you — what your own reactions were." This attitude is the key to the magic of

much of Beebe's writings. In the descriptive passages of his many books he somehow personalizes his experiences so that the reader is beside him.

He dared to write in his own fashion at a time when it was thought that all scientific writing must be purely methodical. Time has changed all this and today many a scientist and naturalist endeavors to write more colorfully and interestingly. None can excel the earlier adventurer, Beebe, who dared to live up to his vision that the wonders of the natural world belonged to everybody.

Only those who worked intimately with him realized how intensely he believed in accuracy and in the provability of any observation. In this regard he was a true scientist, superbly equipped with powers of observation which frequently were an amazement to his associates. His goal was to gain fuller understanding of the living environment as a whole. His work contributed in many respects to a better understanding of evolutionary processes but above all it opened new pathways to the science of ecology. There is no "end" to accomplishments such as these — their influence will run on through time.

CONSERVATION



Noel Eichhorn

Latest in a distinguished line of young research associates at the Conservation Foundation is Noel Eichhorn.

Noel received his B.A. degree at Lehigh University where he majored in geology. He received his impetus and feeling for conservation from the fact that he was commissioned as a flier in the U. S. Naval Reserve in October, 1954. If this seems a somewhat roundabout approach it may be explained by the fact that in April, 1955, he was transferred to Air Development Squadron 6, a newly organized unit used in support of the Antarctic program of the International Geophysical Year. It was this experience which led him to a particular interest in the very broad field of ecology. Separated from the Navy in the summer of 1958 with the rank of Lieutenant, he was free to pursue his new-found interest and became a candidate for the Master of Science degree in conservation at Oregon State College. Noel travelled extensively in Europe in 1961, with principal headquarters at the University of Stockholm in Sweden. His work at that university concerned the effects of changes in the general atmospheric

FOUNDATION

circulation on the behavior of glaciers. He was granted his Master's degree at Oregon State early in 1962.

Noel's main and immediate ambition is to get out into the field with Frank Fraser Darling and get the National Parks Survey under way.

New Alaskan Study

Richard Cooley and George W. Nichols, Director of the Alaska Division of State Planning, have prepared a study of "Alaska's Population and Economy, Regional Growth, Development and Future Outlook" which includes numerous statistical tables that make possible historical comparisons of regions within Alaska and the other States. It will be used in planning programs, particularly those concerned with State capital improvements. One of the most pressing problems now, in the transition from a Federal-military economy to a natural resource-based economy of forestry, coal and iron exports, and tourism, is the development of an adequate transportation network. Another is an analysis of human resources in areas where there are high ratios of nonworkers to workers. This study is now available from the Division of State Planning, Office of The Governor, Juneau, Alaska.

Briefly Noted

On June 10 Fairfield Osborn received the degree of Doctor of Science from the University of Buffalo . . . Dr. Wallace Bowman is returning to our staff as Associate Director of Research in early August after a year as a resource planner in the Alaska State Planning Commission. He will be Acting Director in Dr. Darling's absence . . . Dr. Richard Cooley has been appointed Research Professor of Economics at the University of Alaska, and is working on a study of highways and resources . . . In September the University of Chicago Press will publish "Grain Yields and the American Food Supply" by Gale Johnson and Robert Gustafson, both professors of economics.

This study analyzes all major measurable factors affecting U. S. grain yields and indicates that output can increase sufficiently to meet our requirements in 1980 . . . On August 17 Double-day will publish "Our Crowded Planet," a collection of essays edited by Fairfield Osborn, which

examines population pressures from the points of view of biology, economics, politics and religion. André Maurois, Sir Julian Huxley, Joseph Wood Krutch, Sir Charles G. Darwin, Arnold Toynbee and Father Robert I. Gannon are among the contributors.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Dr. John Tee-Van Retires As General Director

After 50 years, 10 months and 13 days in the service of the New York Zoological Society, Dr. John Tee-Van retired on July 5 at the age of 65. Except for Dr. William Beebe, he is the only member of the staff ever to achieve fifty years of active service — and is likely to be the last, for



The "Tee-Van Oak" is planted on July 5.

he began work in the Zoo (as a very junior keeper in the Bird Department) in 1911 at the age of 14. No permanent employees are hired at such an early age nowadays.

Dr. Tee-Van's career was outlined in an article by President Osborn in the September-October, 1961, issue of *Animal Kingdom*.

His associates in the Zoological Park and the Aquarium gave a luncheon and tea in his honor on July 5, and during the afternoon an oak tree, marked by a bronze tablet, was planted in the center of the Zoo to record his achievements of half a century.

Since then Dr. Tee-Van has returned to the Department of Tropical Research laboratory in the Zoological Park, to continue work on fishes which he virtually discontinued about twenty years ago under the pressure of administrative duties.

African Boy Is Actor In Society's Film

To arouse the interest of Africans in the conservation of their land and wildlife, the Zoological Society last year sponsored and financially assisted the making of a motion picture film in which three native boys visited the national parks in Tanganyika. Now one of the boys, Onesmo Moiyo of Il Boru, has been visiting the Yellowstone National Park and is again the "hero" of a conservation film, showing the use that Americans make of their national parks.

Both pictures were filmed by William H. Eddy, Jr., the Society's Associate in Education. Young Onesmo will narrate the film in Swahili for the African audience.

IN BRIEF

The Death of Teddy. The oldest animal in the Zoological Park, in terms of time in captivity, has long been the South American Tortoise (*Geochelone denticulata*) called Teddy. Now the distinction passes to a bird, for Teddy died by accidental drowning on June 9. He had come to us on March 26, 1914, as a gift of Theodore Roosevelt. At the time of his death he weighed 53 pounds and his carapace was 21½ inches in length. The new holder of the longevity-in-captivity record is an Azure Jay (*Cyanocorax caeruleus*) which came to us on October 29, 1925.

Another Palm Civet. An African Palm Civet was born in the Red Light Room in the Small Mammal House on May 12. While the animal is neither rare nor particularly noteworthy in itself, this seems to be the first time that the gestation period has been recorded: it was born 64 days after an observed mating.

Big Year for Eggs. More than 1,200 eggs were collected around the Zoo this spring, mostly from the waterfowl, and some 300 of them have been hatched in the Bird House incubators.

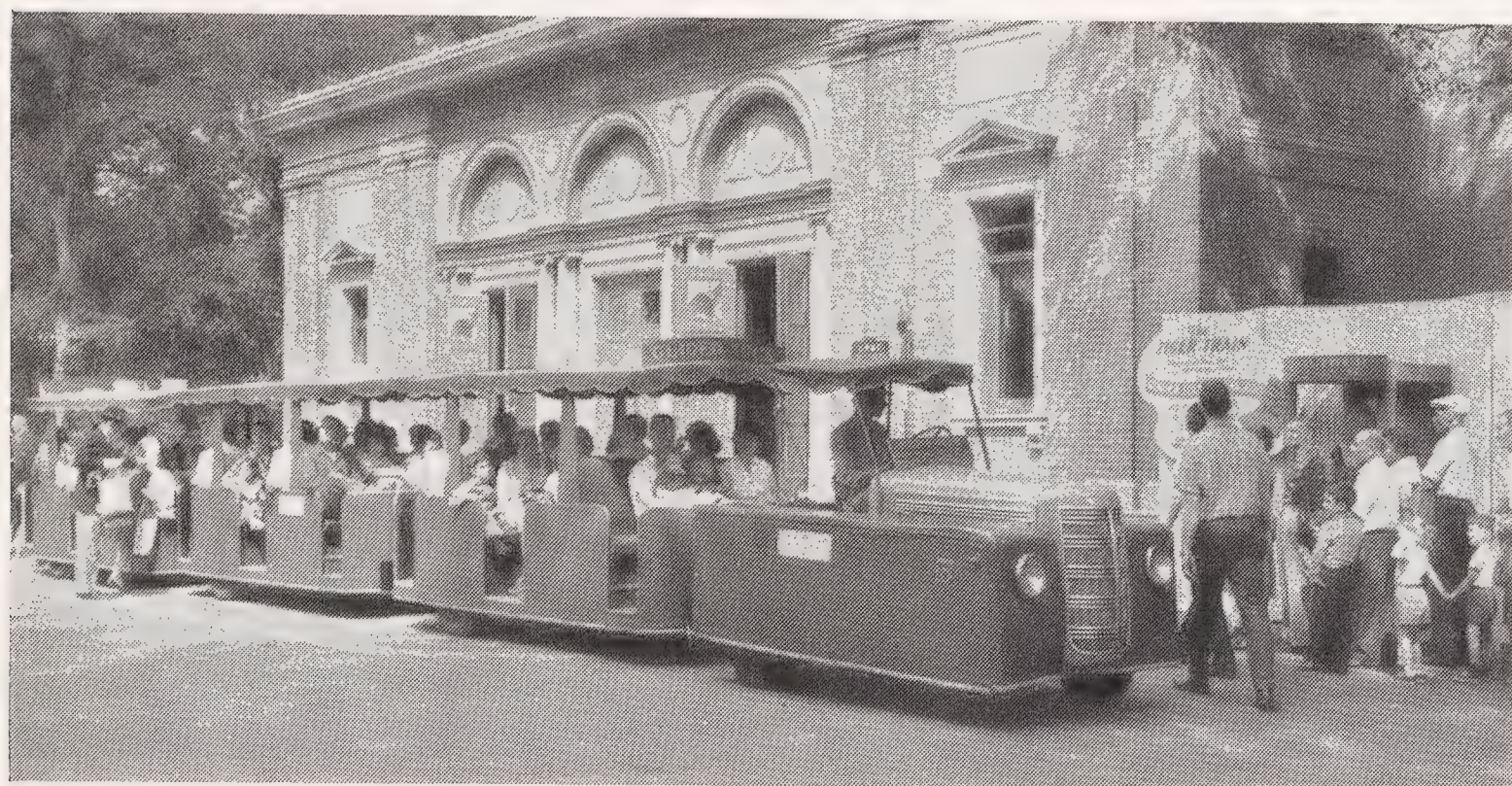
Ornithologists at Zoo. Ninety-eight distinguished ornithologists and conservationists from all over the world were guests of the Zoological Society at a luncheon at the Zoological Park on June 14. They were members of the International Council for Bird Preservation, meeting in New York.

Dr. Dowling Returns from Galapagos. Dr. Herndon G. Dowling returned on June 15 from a two-and-a-half-month's expedition to the Galapagos Islands, bringing back a collection of Marine and Land Iguanas and Galapagos Tortoises. An account of his investigations will appear in the next issue of *Animal Kingdom*.

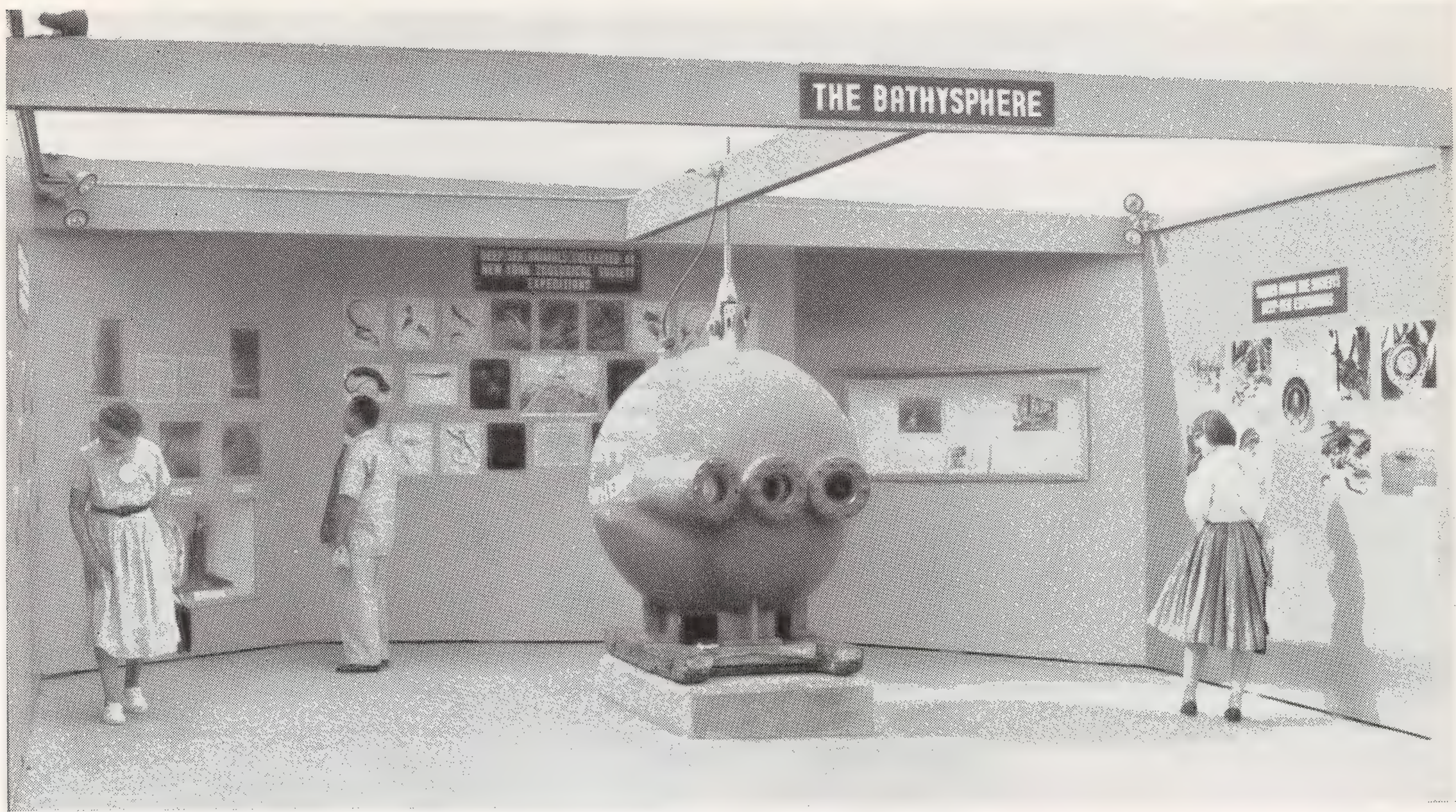
Station Named for Dr. Beebe. The Trinidad Field Station of the Department of Tropical Research has been renamed "The William Beebe Tropical Research Station" by action of the Board of Trustees at a meeting on June 19. At the same time Miss Jocelyn Crane, Assistant Director of the Department, was given the new title of Directing Curator.

Monkey-eating Eagle Recovers. When such a large and active bird as a Monkey-eating Eagle fractures both legs, the chances of recovery might not seem very good. However, our specimen has apparently recovered completely after breaking both legs, presumably as a result of panicking during a severe thunderstorm on the night of May 24. The bird was anesthetized and both fractures were realigned and splinted by Dr. Gandall. He was able to remove the splints on June 15.

To Control Poaching. Poachers who make "kill and run" raids on the animals protected in the national parks are a serious and sometimes critical problem in Africa. To aid the authorities of the Tanganyika National Parks in the control of poaching, the Zoological Society has made a grant from its African Wildlife Fund to purchase Field Radio-telephone apparatus for wardens and enforcement officers.



An innovation that has had great success in the Zoological Park is the "Tiger Train" that makes lecture tours of the Zoo lasting 30 minutes. Four trains are in operation every day except Sunday, and tours will continue well into the autumn.



The original Bathysphere in which Dr. Beebe made his dive to 3,028 feet — a record unsurpassed for 15 years — has been set up at the Aquarium, surrounded by photographs, models, and drawings of deep-sea fish and technical publications resulting from the explorations.

PUBLICATIONS OF INTEREST

The Natural History Library

Ten more paperbacks have been added to the "Natural History Library," a series published by Doubleday Anchor Books in cooperation with the American Museum of Natural History. Their selection is guided by a board of Museum staff members, and the aim is to provide "books of enduring interest in the life and earth sciences" at moderate prices. The new volumes are:

\$1.45

Theodore Roosevelt's America. Edited by Farida A. Wiley.

The Voyage of the Beagle. By Charles Darwin; edited by Leonard Engel.

The Heathens. By William Howells.

Early Man in the New World. By Kenneth Macgowan & Joseph A. Hester, Jr.

\$1.25

The Heritage of the Bounty. By Harry L. Shapiro. Puffins. By R. M. Lockley.

Grand Canyon. By Joseph Wood Krutch.

Between the Planets. By Fletcher G. Watson.

95¢

The Land of Little Rain. By Mary Austin.

Observations and Experiments in Natural History. By Alan Dale.

All are illustrated by photographs or drawings, the type is clear and clean.

OOKIE: THE WALRUS WHO LIKES PEOPLE. By William Bridges. 64 pp., 40 photographs, mostly by Emmy Haas; additional ones by Sam Dunton and Stan Wayman (*Life*). William Morrow & Co., New York, 1962. \$3.50. (Paperback edition at Bronx Zoo and Aquarium, \$1.75.)

Reviewed inside back cover.

H. D. THOREAU: A WRITER'S JOURNAL. Selected and edited by Laurence Stapleton. xxxii + 234 pp., Dover Publications, New York, 1960. \$1.55.

The growth of Thoreau's thoughts about nature and his development as a writer, exemplified in generous and unified extracts from his Journal.

THE EYES OF DISCOVERY. By John Bakeless. 439 pp., many illus. Dover Publications, New York, 1961. \$2.00.

Subtitled "The pageant of North America as seen by the first explorers." This is a paperback edition of a book first published in 1950. A running story for each section, with many direct quotations from the explorers' writings.

NATIONAL PARKS—A WORLD NEED. Compiled and edited by Victor H. Cahalane. 100 pp., 20 illus. Spec. Publ. No. 14, American Committee for International Wild Life Protection, the Zoological Park, New York 60, N. Y. 1962. \$1.00.

The case for National Parks — the world need — and their current status in 11 countries is stated by 13 well-known conservationists in this booklet issued by the American Committee associated with the International Union for the Conservation of Nature and Natural Resources. It is authoritative and particularly important now in view of the First World Conference on National Parks in Seattle this summer.

EVERYMAN'S ARK. Edited by Sally Patrick Johnson; introduction by Alan Moorehead; illustrated by John Cameron Yrizarry. 331 pp. Harper & Brothers, New York, 1962. \$5.95.

A collection of 31 long, and 7 short, selections from the writings of professional naturalists and others, illus-

trating their personal relations with animals. Miss Johnson has ranged widely in making her choice and has included many superb pieces of writing and observation — not all of which are likely to be familiar to most people.

HEART OF THE WILD. By Chet Schwarzkopf, illustrated by Wayne Trimm. 234 pp. Doubleday & Co., 1962. \$3.95.

Seventeen stories about animals of the redwood coast of California, told with feeling for the drama of their lives.

New Members of the New York Zoological Society

(Between May 1 and June 30, 1962)

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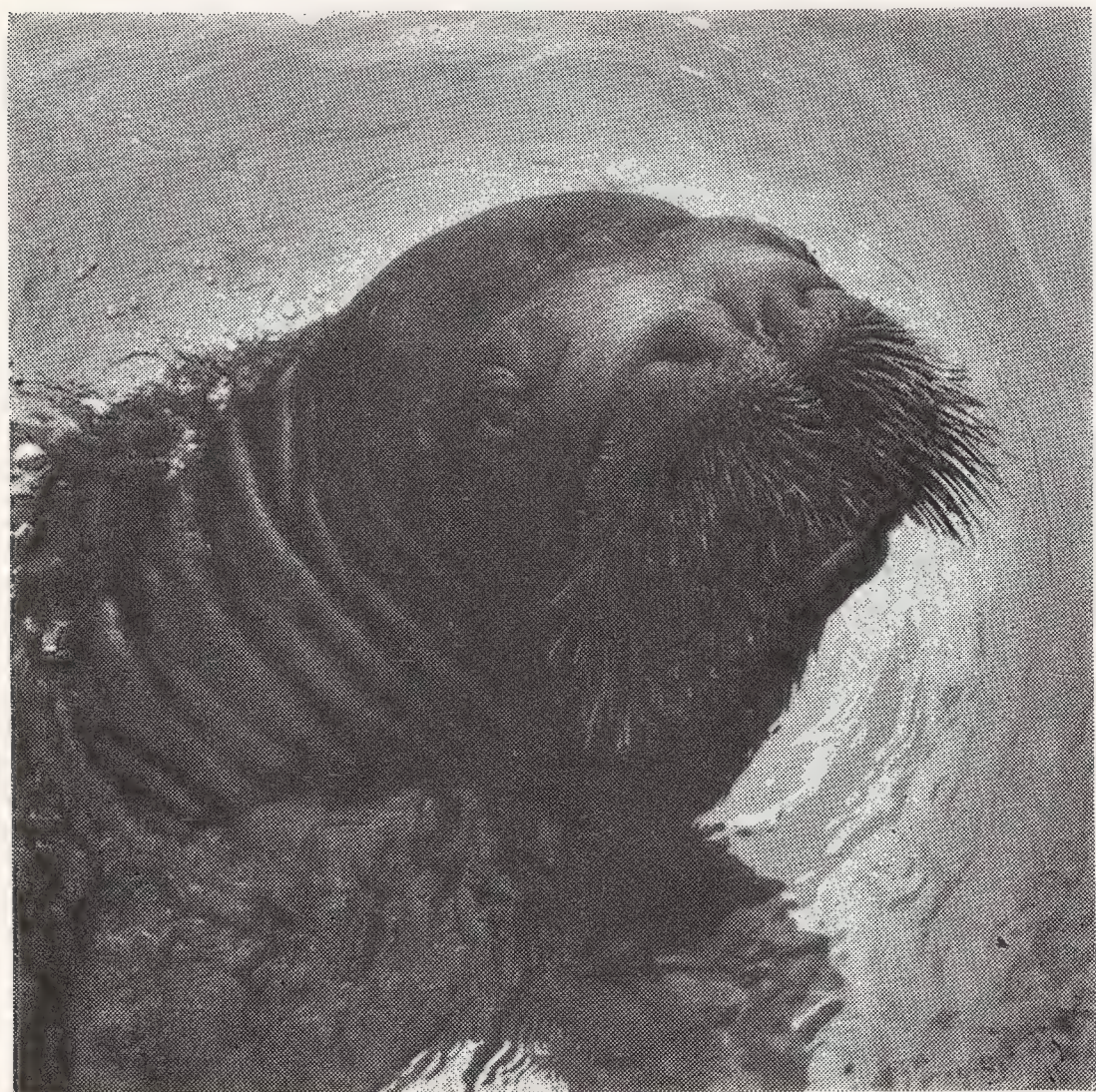
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OOKIE LIKES PEOPLE



AND WE LIKE TO
GIVE HER NEW
BOOK A SPECIAL
REVIEW . . .

IT'S EASY ENOUGH to see why people like Ookie—she's fat, floppy and responsive as a puppy—but it's a little harder to see why Ookie likes people. But she does, and thereby hangs a tale.

To tell it, that consummate teller of Zoo tales (Zoo Babies, Zoo Celebrities, Zoo Doctor, Zoo Expeditions and Zoo Pets) Curator of Publications William Bridges makes adroit use of some wonderfully cosy photos by Miss Emmy Haas and Staff Photographer Sam Dunton. It all adds up to a handsome book—big and expansive, as befits its subject.

Starting from the moment when she was taken into a boat (made of walrus skin) in Alaska and timidly uttered her first "Ook-Ook," Mr. Bridges recounts with relish the vicissitudes of Ookie's good-natured adjustment to life in Coney Island. We follow every step of her growing up, her weaning, her playmates, her amusements and her deep affection for her sensitive Keeper, a trusting dependence that grows to include and embrace all who visit her in the New York Aquarium.

To tell the story, Mr. Bridges uses a direct no-nonsense prose that gets through to readers with no detours or road blocks. "Ookie," the walrus who likes people, is very possibly the best book of this series he has written, and its subject the most engaging.—GORDON CUYLER.

OOKIE, THE WALRUS WHO LIKES PEOPLE. By William Bridges, Curator of Publications of the New York Zoological Society. 64 pages, many photographs by Emmy Haas and Sam Dunton. Published by William Morrow & Co., 1962. Hard Cover: \$3.50, Paperback (at the Zoo and the Aquarium): \$1.75.



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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Vol. LXV OCTOBER 1962 **No. 5**

Issued bi-monthly at the Offices of the New York Zoological Society, 630 Fifth Avenue, New York 20, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

The Wealth of the Society's Interests

THERE IS AN IMPRESSION in the minds of a good many people that the work and interests of the Zoological Society are confined to the Zoological Park and the Aquarium. There is some reason for this delusion because the Zoo and the Aquarium, attracting as they do some three million visitors a year, are so widely known and publicized. However, the Society has other vital interests. These involve work for the protection of wildlife here and abroad and extensive programs of scientific research in the field and in laboratories. At no time in our history have these corollary purposes been more important or more vigorously pursued.

The lead article in this issue, describing our recent expedition to the Galapagos, reflects the Society's continuing interest in the status of the remarkable fauna of those islands. This is the fifth expedition the Society has sent there. The major purpose of all of these was not only to study the animal life but, at the same time, to call attention to the urgent need for the protection of a fauna whose existence is so critically threatened.

Another article in this issue concerns the recent acquisition of a pair of the rare Square-lipped Rhinoceros or "White Rhino" from Zululand. From the "Zoo" point of view, it is an achievement to have these animals in our collections. Next to the elephant they are the largest land-living mammals in the world. However, there is another value in their coming. The officials of the Umfolozi Game Reserve sent them to us in order to establish reserve breeding stocks elsewhere, for it is now recognized that the "White Rhino" is gravely threatened in its wild state. The first goal of wildlife conservation is preservation of a species in its natural environment. This, however, does not deny the valuable part that a zoological park can play in maintaining and propagating reserve stocks of rare animals. Zoo management has made great strides in recent times, as evidenced by the fact that such animals as the gorilla and the okapi are now successfully bred and reared in captivity. Such an accomplishment was undreamed of even twenty-five years ago.

One of the important plans in our development program is the establishment of a Wildlife Survival Center in the Zoological Park. Its purpose is twofold: one, a place for maintaining and propagating rare species; the other, to focus public attention upon the pressing need of wildlife protection throughout the world.

Because of the essential part that both wildlife protection and scientific research play in the purposes of the Society, the next issue of this magazine will contain an article describing our present work in these fields.

Fairfield Osborn

SMITHSONIAN INSTITUTION OCT 22 1962

The Zoological Society's
Fifth Expedition to the
Galapagos Islands

WORLD'S
END
REVISITED

By HERNDON G. DOWLING

Curator of Reptiles

THE FIFTH ZOOLOGICAL SOCIETY EXPEDITION to the Galapagos Islands arrived at Wreck Bay, on San Cristobal, on April 9, 1962. This was just 31 years and 360 days after the Astor Expedition, the last Society-supported expedition, had left these islands. The long-standing interest in the Galapagos exemplified by these five expeditions is shared by all biologists. For it was here in 1835 that a young British naturalist first observed the strange mixture of animals that the islands possess — species different from those of the adjacent mainland and even differing from island to island, yet with a broad underlying similarity in each case.

That young naturalist was Charles Darwin and the observations he made here served as a springboard for a new and radical idea on the way that these islands, and the whole earth, might have been populated. This idea, matured through the years and buttressed with many additional observations, appeared in 1859 as his

revolutionary theory of organic evolution in the "Origin of Species." Thus, although the islands were first discovered in 1535 and are politically a part of Ecuador, to a biologist they will always be "Darwin's Islands," with a (biological) discovery date of 1835.

Four persons made up this latest of Zoological Society expeditions. Accompanying me through the partial support of their own institutions and their own resources were Robert S. Chase, Jr., biologist, reptile embryologist and assistant dean of Lafayette College at Easton, Pennsylvania; Rene Honegger, a zoologist from the Zurich, Switzerland, Zoo with an especial interest in giant tortoises; and David S. Boyer, a member of the Foreign Staff of the National Geographic Society, who accompanied us as photographer.

We had expected to spend about four weeks in the islands, arriving there and leaving by the "monthly" mail and supply vessel that services them from the port of Guayaquil, Ecuador. This





ship, the *Cristobal Carrier*, went into dry dock after leaving us on the islands, however, and there we remained for more than eight weeks until we were able to obtain passage on the next available means of transportation, a coastal freighter named the *Don Lucho*. We utilized this additional time to extend our researches. By chartering local fishing boats for inter-island transportation, we were able to visit a total of ten before leaving the archipelago on June 7.

The islands themselves are unusual enough to be of especial interest from geologic, topographic and climatic viewpoints. Scattered across the equator some 600 miles off the coast of Ecuador, they are basically a cluster of rocky peaks that rise from the ocean depths to project above the level of the sea. From an ocean floor more than 1,000 fathoms below, some of the tallest peaks rise more than 5,000 feet into the air while others

About 2,000 Marine Iguanas live on tiny Jensen Island in the mouth of Academy Bay, Santa Cruz. The island is some 1,500 feet long, 1,000 feet wide, but there is plenty of grazing for the lizards on seaweed that covers tumbled rocks offshore, and nesting places in the sand behind the beach. Below — The islands extend 250 miles north-south, 150 miles east-west.





barely break the water's surface at low tide. The furrowed black lava fields and cone-shaped mountains on all bespeak their recent volcanic origin. The ten major islands thus formed, of which only one exceeds 30 miles in length, together with their associated islets, rocks and banks, make up the archipelago commonly known as the Galapagos.

Although the Galapagos straddle the equator, these are no lush tropical islands. The cold Humboldt Current sweeps up the west coast of South America straight from Antarctica and then turns westward to filter through these lava-capped mountain tops, bringing temperate rather than tropical temperatures. The ocean's temperature stayed at or very near to 70 degrees (F.) during our entire stay — not a very tropical ocean. It gets even cooler during the July to September "garua" season when the islands get a more direct effect of the Humboldt Current. This same cold current has also wrung the atmosphere of much of its available moisture before it reaches the islands, giving dry, semi-desert, conditions throughout the archipelago except at the higher levels of some of the larger islands.

Prior to man's invasion of the islands, beginning soon after their discovery in 1535, the animal life had more resembled that of some prehistoric reptilian era than modern mammalian times. Herds of giant tortoises migrated from upland valleys to coastal sands, slowly carving

A bust of Charles Darwin, who "discovered" the Galapagos in a biological sense in 1835, faces northeast across Wreck Bay, San Cristóbal, the chief port and checkpoint for ships.

broad pathways across the terrain. Thousands of Marine Iguanas lined the rocky coasts and inland the large Land Iguanas joined the tortoises in their meals of cactus pads and other vegetable delicacies. The bird life, while perhaps not as impressive, was equally unique, while mammals, dominant on most parts of the earth, were represented only by the aquatic seals and sea lions, a small native rat and a single small species of insectivorous bat. Nowhere else in the world did reptiles occupy such a dominant position in a fauna, and of the various animals found on the Galapagos more than eighty per cent. were found nowhere else. All of the animals of the islands were extremely tame and unsuspecting of man's intentions and even small birds could be caught with the hands or knocked down with a short stick.

Once this situation became common knowledge, a vast change in the faunal relationships began. Sailors found that the tortoises were ideally suited as a source of fresh meat on the long sea voyages. They could be collected in large numbers and stored alive in the ship's hold for months without needing food or water. After

this discovery they were collected by the thousands and were used as a major source of meat by the American and British whalers of the eighteenth and nineteenth centuries. Some of the smaller islands were completely cleared of tortoises by the 1850s. Meanwhile the flesh of the Land Iguana had become recognized as a delicacy and it, too, began to disappear from the more visited islands.

While the native animals were thus being decimated, other animals were being introduced, accidentally or purposefully. Goats and donkeys were set free or escaped from passing ships. Cattle and pigs escaped from some of the early settlements. All of these animals, in the absence of predators or other natural controls, multiplied mightily and large feral herds came into existence. These new mammal herds competed with the native animals for the small amount of water and green vegetation that was available. Those ancient associates of man, "Norway" rats and house mice, began to appear on various of the islands and the dogs and cats that were imported for their control also escaped into the wild and

began to feed on the more easily captured native birds and lizards. Together with the feral pigs, these bands of dogs and roving cats became a major menace to the eggs and young of all native animals, even the giant tortoises. By these various processes many of the native animal populations already had been greatly reduced by the time of Darwin's visit. Additional species have disappeared completely since that time.

We had obtained all of this information from a study of the literature before visiting the islands. The California Academy of Sciences also has had a long-standing interest in the Galapagos and the papers derived from their year-long expedition in 1905-1906 and subsequent expeditions had summarized the status of the animal life at that time. Zoological Society expeditions had contributed additional information in the twenties and thirties and more recently a four-month

The expedition's fishing boat anchored in the cove on the east coast of Duncan Island where, in 1923, another Zoological Society expedition landed a party to investigate giant tortoises.

Photo by Robert S. Chase, Jr.





Life-UNESCO expedition had made a survey of the fauna in 1957.

The Charles Darwin Foundation which the New York Zoological Society had helped establish and finance, had a research station on Santa Cruz since the time of the UNESCO survey. We hoped that this station's activities might have had some strong salutary effect on the preservation of this unique fauna. I had been in touch with the Director of the station by letter but communications were so slow and erratic between Galapagos and mainland that we were not sure just what working conditions we might find.

Our expedition was primarily aimed at a better understanding of the unique reptilian fauna of the islands and each of the biologists had a specific project in mind that might be completed in the four-week stay that we contemplated. Rene Honegger wanted to discover as much as possible about the natural history of the giant tortoises, the conditions under which they live, what the reported "migrations" from the highlands repre-

sent, how many tortoises remain today, and what their chances of survival were. Bob Chase hoped to obtain embryological material of some of the strange and rare animals of the islands. Some of the animals, the Marine and Land Iguanas, the Lava Lizards and even the giant tortoises in some localities were reported to occur in such large populations as to make such a program practical and without danger to their continued existence.

I hoped to study that unique lizard, the Marine Iguana, in an intensive fashion — its ecology, life history and habits. This was of both scientific and practical interest. Though certain of its breeding habits had been previously reported, almost nothing was known of its basic requirements for existence. And if enough of these requirements could be discovered, perhaps we could maintain a colony at the Zoological Park. No one had been able to accomplish this until now. As soon as these gentle but fearsome-appearing lizards are removed from their native shores, they steadfastly refuse to open their

South Plazas is the home of one of the few colonies of Land Iguanas — goats have been killed off, leaving the *Opuntia* cactus for the lizards.

This is what happens to the cactus when goats run wild; they consume even the thick stems for the sake of the little moisture they contain.

mouths. Thus begins a hunger strike that ends only with the death of the lizard some weeks later. Such were the unknown factors at the base of this study.

As we each began our individual projects and as we traveled from one island to another, observing the various animal populations and their conditions of life, and discussing our observations among ourselves, with our guides and with other inhabitants of the islands, it gradually became clear that the status of these animal populations was not as well understood as the reports would indicate. It also became evident that the recent UNESCO reports had, if anything, been over-optimistic about their present status and future prospects.

It is this aspect of our observations that I wish to present to the members of our Society here. We did accomplish our short-term projects and these will be reported later in *Zoologica* and other scientific journals. Meanwhile, however, I believe that the critical situation of the native animals of the Galapagos will be of interest to all. Ours was a herpetological expedition and I will restrict my discussion to the status of the reptile populations. However, the general conditions that endanger the reptile populations also affect the other animals and many of those species are equally threatened.

The greatest enemy to the fauna is today, as it has been for the last four hundred years, man. It is not just any man, though, but specifically the men who make up the crews of the some fifty fishing boats that are based in the islands. These men know the position of every colony of Land Iguanas, the breeding grounds of the giant tortoises, and any other place where they might find meat for supper when fishing is poor.

While these and most of the other animals that need protection are on the Ecuadorian list of



“protected species,” there is no enforcing arm of the Fish and Game Department, only a few scattered “inspectors” whose jobs are mainly political.

Another problem lies in the way that the protective laws are written — or at least in the way that they are interpreted on the islands. According to the islanders it is not against the law to *possess* these protected animals; it is illegal only to kill them or to ship them off the islands. Under this interpretation many small tortoises are kept as “pets,” often suggestively enough in the chicken yard. And, assuming that enforcement were some day attempted, if a fishing boat is found to have a tortoise aboard who is to say whether it is a pet, or just lunch? Thus, while it may be difficult for a non-Ecuadorian to obtain a permit to collect a single specimen, meanwhile hundreds of these same animals are being used as a standard item of diet by certain of the islanders.

THE REPTILE FAUNA of any one island is actually very small. It is the fact that each island

is likely to have its own unique species of each of the general types that makes them interesting. As Darwin noted in 1835, "it is the circumstance, that several of the islands possess their own species of the tortoise, [etc.] . . . these species having the same general habits, occupying analogous situations, and obviously filling the same place in the natural economy of this archipelago, that fills me with wonder." Thus, a typical island will have four kinds of lizards: a gecko, a Lava Lizard, a Land Iguana and a Marine Iguana. Other reptiles are likely to be only a single kind of snake and one form of tortoise. This same population is repeated from island to island, but on each the Lava Lizard and tortoise are unique and distinct from those of the adjacent islands. Although the other kinds may appear fairly similar superficially, close study indicates that these too are different. This situation is not restricted to the reptiles, but is characteristic of all of the animals and plants native to the islands.

The less conspicuous reptiles are not affected directly by the presence of man and in many cases their populations have never been recorded in a fashion that would allow a judgment on whether they are increasing in numbers, decreasing or holding their own in spite of the changes in fauna and vegetation. The geckos (*Phyllodactylus*) are an example of this kind. Small and nocturnal in habit, they are seldom seen unless a special night-time search is made. It is still more of a question as to whether they ever occurred on certain islands than it is on whether their populations have diminished. The snakes (*Dromicus*) are in a similar situation, with only a few specimens having been reported from any of the islands. We found them to be quite common on Fernandina, Santiago and Hood islands — if you looked for them at the right time of day. This turned out to be in the morning between eight and ten and in the afternoon between four and six. The snakes of Santa Cruz

are said to have almost disappeared during a time when the population of feral cats was high. Now that the cat population has been brought under control (?), some snakes are again found in the vicinity of Academy Bay. Although the snakes seen now are tan, the older colonists of Santa Cruz talk about the "green snakes" that used to inhabit the highlands. Was this a different species? If so, does it still exist somewhere? Questions like these fill our notebooks.

We became acquainted with the ubiquitous Lava Lizards (*Tropidurus*) on our first day in the Galapagos. We went ashore at Wreck Bay, the headquarters of the naval district on San Cristobal where all ships must report in and out. Now a metropolis of some 600 persons, Wreck Bay is the largest settlement in the islands and together with the other villages raises the island's population to about 1,000 persons — half the population of the entire archipelago.

On the beach and nearby the island's endemic species of Lava Lizard (*Tropidurus bivittatus*) was extremely common. Running across the sand, sunning on top of a rock or scrambling up the trunk of a tree, it was reminiscent of a rather terrestrial species of North American spiny lizard (*Sceloporus*) in both appearance and habit. As I watched it chase flies, recorded its body temperature and observed the surprising territoriality displayed in females as well as males,



Left — A Blue-footed Booby on its nest on Hood where sometimes 3 or 4 nests are crowded into an area of 10-foot radius. Center — Sea Lions are tame and playful, but are still hunted for the sake of their skins. Right — A Flightless Cormorant on Isabela; only about 500 remain.

Center and Right: National Geographic Society Photos

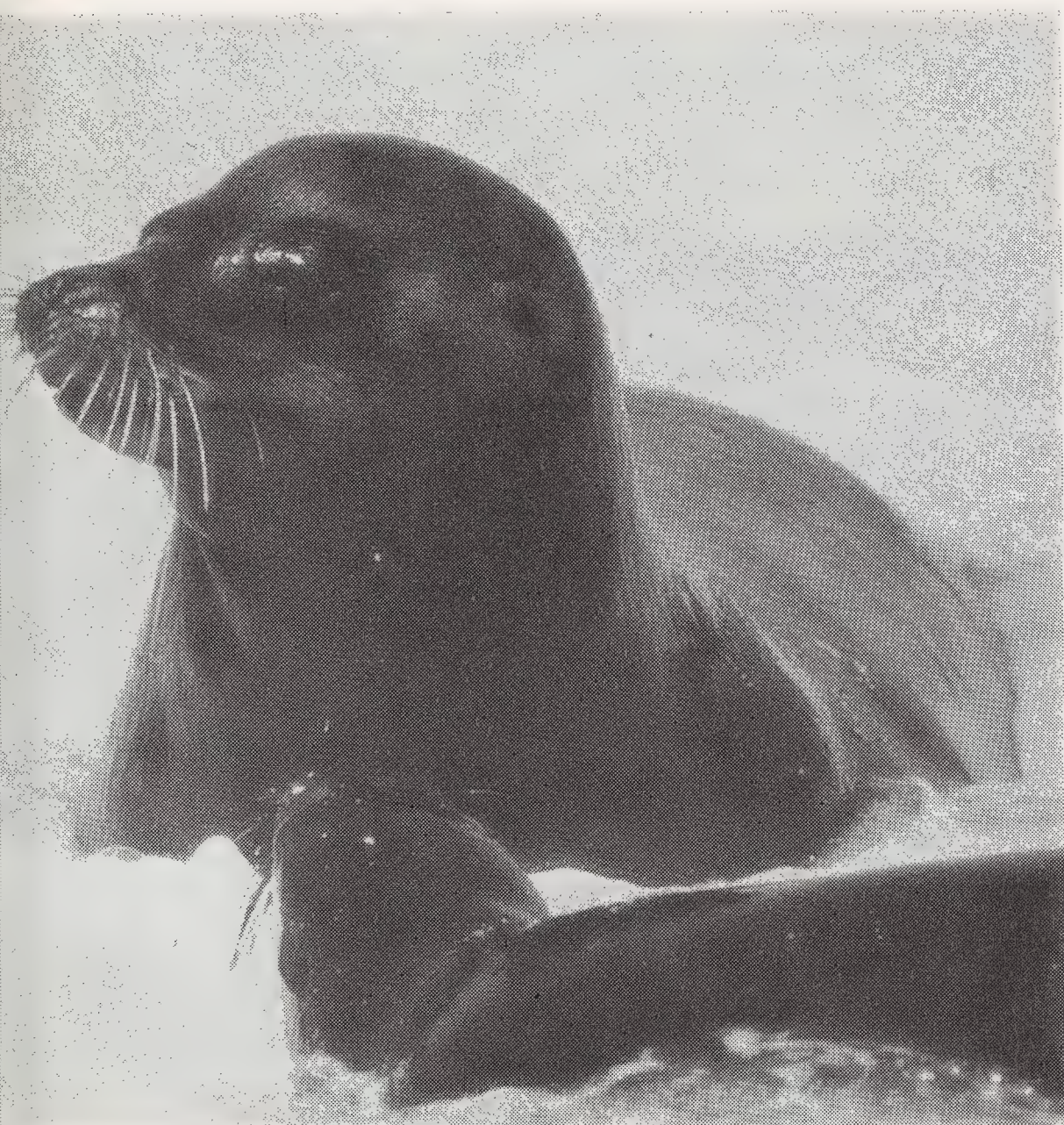
I wondered what interactions were taking place between this high population of lizards and the large human population. I knew that on Floreana, one of the islands that had been inhabited for a long time, the unique species of Lava Lizard there (*T. grayii*) had become extremely rare — presumably from being preyed on by feral cats. Could it be that on San Cristobal people had killed off the lizard's natural predator, the snake *Dromicus*, and had not yet furnished a substitute in the form of feral cats? Or was it merely that on this best-watered island the home garbage piles and chicken yards produced so many additional insects that the lizard population prospered in spite of continual predation? Was this high population a temporary state, soon to be decimated? We do not know.

Later we found Lava Lizards to be common also on the islands of Santa Cruz, Hood, Santiago and Fernandina — but not so impressively common as on San Cristobal. The lizards were relatively scarce on Duncan Island, fairly obviously because the "Norway" rats were eating everything in sight. They were scarce and timid on Isabela also, and we could not imagine why until the "meow" of a feral cat caught our ear. Apparently the cat is the only "exotic" animal that has been able to make its way across the rough lava from the south to the northern part of the island. Undoubtedly it has done so by

utilizing lizards and small birds for both food and drink.

One interesting aspect of the natural history of these lizards was pointed out to me by Dr. Charles C. Carpenter of the University of Oklahoma. This is that the Lava Lizards, those of Santa Cruz anyway, lay only one clutch of eggs per year — this clutch usually containing only two eggs. Such an unusually low reproductive rate is probably a reflection of a low mortality rate under previous "natural" conditions and may be characteristic of isolated island species. Mainland spiny lizards of comparable sizes, for example, commonly lay five to twelve eggs per clutch. In any case, a species with such a low reproductive rate cannot be expected to recover rapidly from any unusual depletion of numbers in a population. Fortunately, such depletion has so far occurred in only a few localities.

The Marine Iguanas, *Amblyrhynchus cristatus*, have a similarly low reproductive potential — only two eggs to an annual clutch. Restricted as they are to coastal habitats, they would be highly susceptible to extermination should some enterprising leather dealer decide to utilize their skins. Fortunately, their flesh is not considered a delicacy such as that of the Land Iguana and they are not in any danger of being exterminated for food purposes. Although they have disappeared from such long-settled areas as Black Beach on



Floreana and have almost disappeared from Wreck Bay, where we found only a single individual, they still live in large numbers on most of the islands of the archipelago. The population on Jensen Island, a tiny rocky islet at the mouth of Academy Bay, was estimated at two thousand by Gary Knopf and our own observations corroborated this figure. Thus, hundreds of thousands of these strange lizards must inhabit the rocks and coasts of the various islands.

Darwin had noted that the Land Iguanas (*Conolophus*) of the Galapagos were found only on certain islands. "It would appear as if it had been created in the centre of the archipelago, and thence had been dispersed only to a certain distance," he remarked in his *Journal*. We first met

Left — Most Marine Iguanas are still fearless of man. Right — The expedition spent two nights on little Jensen Island, taking hourly temperature readings in the Marine Iguana colonies.

Right photo: National Geographic Magazine

them on South Plazas, a small islet off the east coast of Santa Cruz. It was a real thrill to see the first one lying in the shade of a giant *Opuntia* cactus and to watch its comically wild and cumbersome scramble for cover in its burrow when it saw us. The fact that after such a mad dash it left about one-third of its tail projecting from the burrow indicated how little adapted it was to the dangers of the outer world.

South Plazas is a very small islet, perhaps 2,000 yards long and 200 to 400 yards wide. Its eastern two-thirds is treeless and open except for a few small groups of cactus, while the western third maintains a fairly thick mixture of cactus, acacia and other thorny plants. The iguanas occupy their solitary shallow burrows in both the open and the vegetated areas. They appear from these burrows at about ten in the morning, sun themselves for an hour or so, eat their fill of cactus fruits or other succulent vegetation, and spend the remainder of the day alternately sunning and getting into the shade — keeping their temperatures relatively constant — until about four in the afternoon, when they are again ready to reenter the burrows.

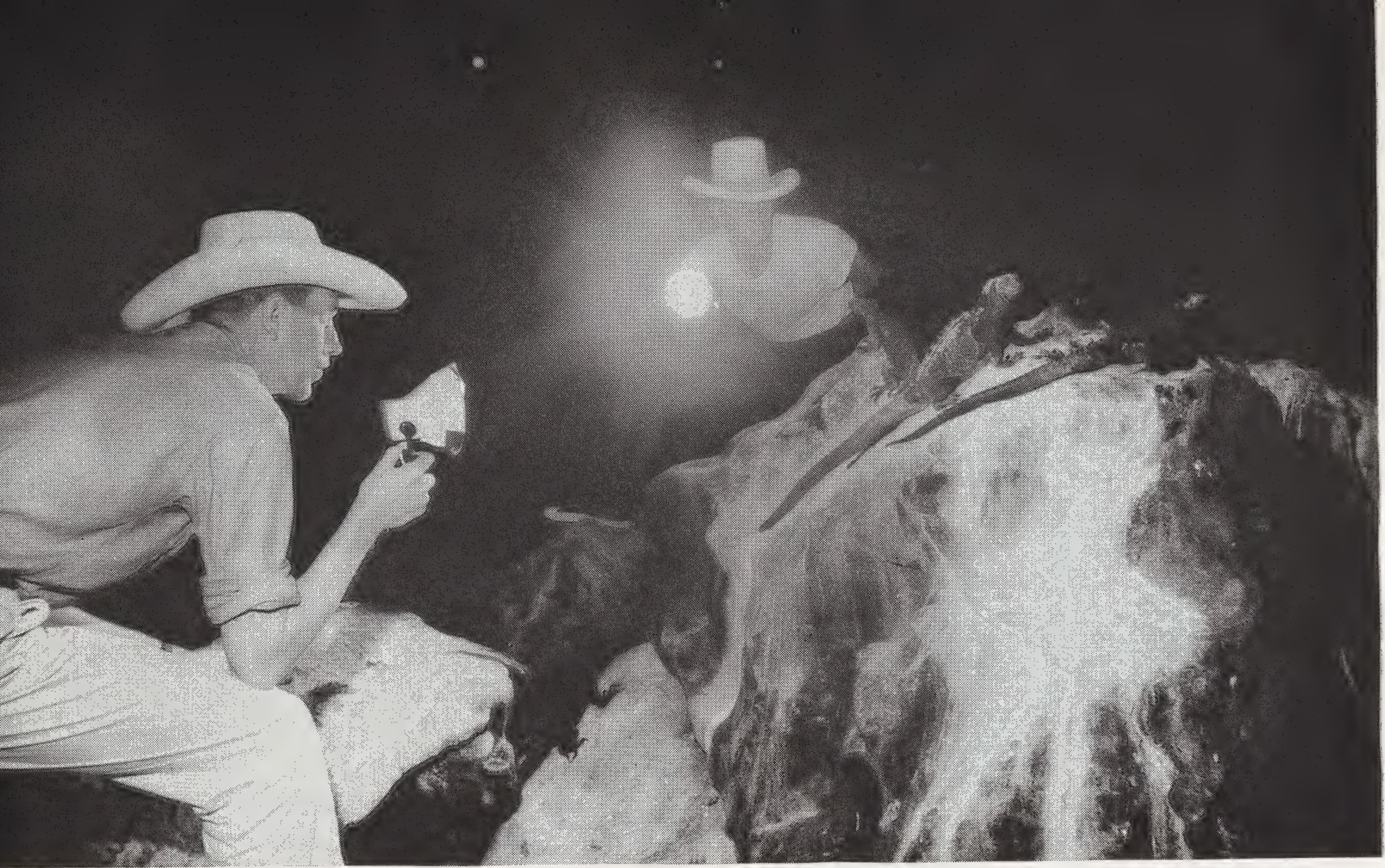
We had been given the impression from the recent published material and from talking with various knowledgable islanders that the Land



Iguanas were common on South Plazas. It is quite true that we were able to find iguanas quite easily almost any time of day. However, a count of the lizards visible, the burrows that showed signs of recent use, and with an added factor for our short period of observation (we spent two full days and parts of two others on the Plazas) still gave an estimate of fewer than 200 individuals resident there. And this is supposed to be one of the areas where the lizards are numerous!

A protected channel and relatively easy landing places make this island a favorite camping locality for the local fishermen, a regular stopping place for the monthly mailboat, and a spot often visited by yachts from other parts of the world. After a consideration of these circumstances and the small land area, much of which is open, the surprising thing is not that the population is small, but that it exists at all.

We noticed that the Land Iguanas of South Plazas were considerably smaller than those from Conway Bay, Santa Cruz, and other islands. When I mentioned this to Carl Angermeyer, an old resident, he said that when he first arrived in the Galapagos in the late thirties the iguanas on Plazas were both larger and tamer than they are at present. Thus, the size difference is probably due to differences in predation rather than being a specific difference. Presumably the iguanas on the Plazas are of the same



species, *Conolophus subcristatus*, as those on Santa Cruz. The predators here are mainly man. Land Iguana tail is still regarded as a delicacy and almost any fisherman is likely to stop at Plazas for a camping place with a readily available source of meat. With the older individuals being continually killed off, the population overall is much smaller.

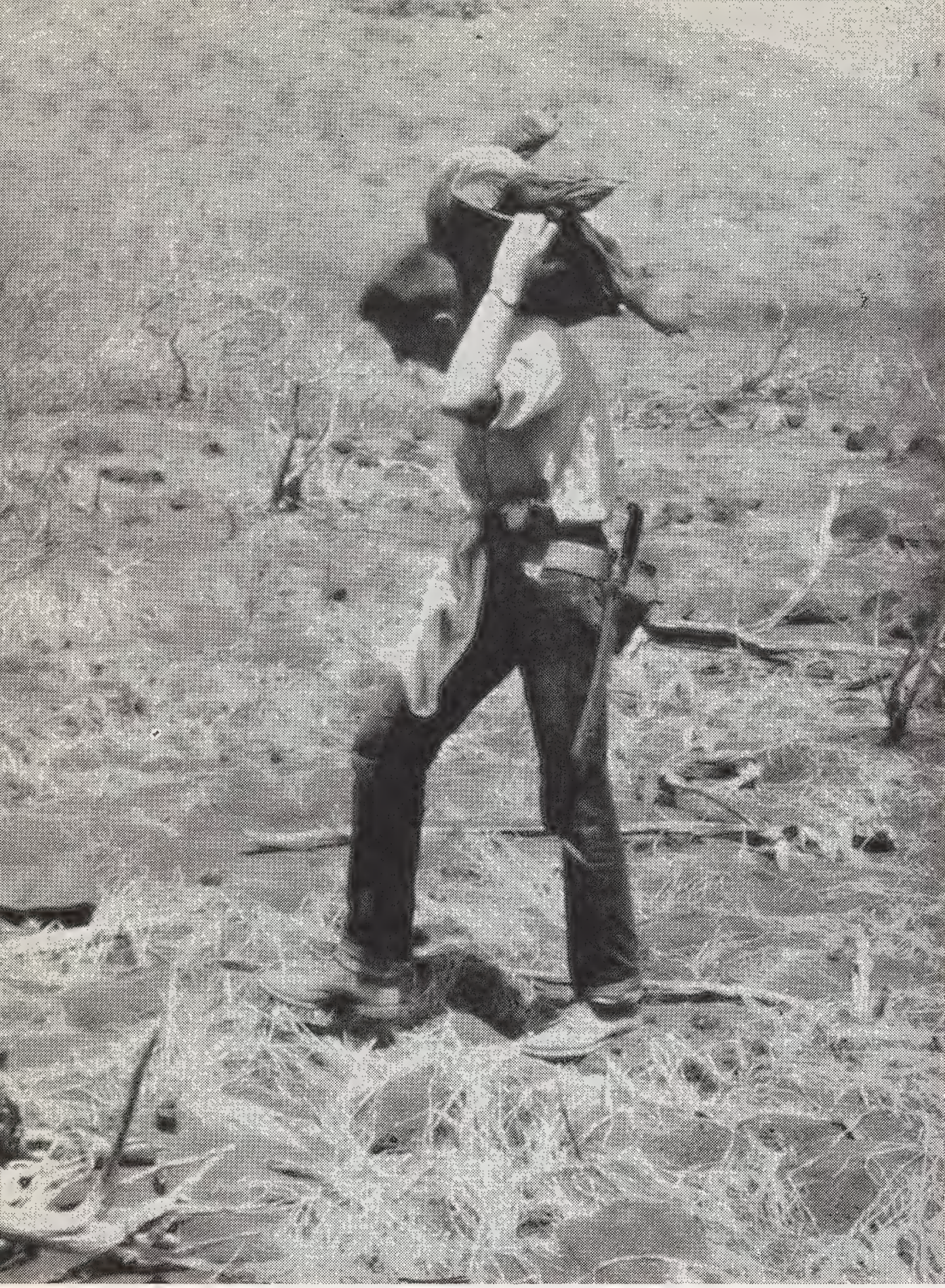
We were pleased to note that individuals of all sizes, from young-of-the-year to adults, were present, indicating that reproduction was continuing in this population. The lack of animal competition and predation is probably responsible

for this. No cats, dogs or rats occur on the island. We were told that goats had been planted on South Plazas at one time but that the previous director of the Darwin Station, Raymond Leveque, had eradicated them recently. This has undoubtedly had a beneficial effect on the Land Iguanas and may be responsible for the relatively large number of young animals observed this year.

As a result of our observations we have suggested that a small group of adult iguanas be collected from South Plazas and released on the less-visited North Plazas island. It would appear to offer equally good habitat, has no exotic pred-



This is a very old Land Iguana on Santa Cruz — a remnant of the disappearing colony. Feral cats and pigs probably eat the eggs and young, so that now only elderly individuals are found and many burrows are not inhabited.



Only one giant tortoise was found on Duncan Island and there are probably less than 50 left. Shells of 5 killed within the year by fishermen were seen. This one was brought to the Zoo.

ators and is less likely to be visited due to the high shoreline and poor landing areas.

The situation on Barrington Island, some fifteen miles south of Santa Cruz, is dramatically different. A different species of Land Iguana, *Conolophus pallidus*, is found here and we had been assured that here, too, the iguanas were plentiful. Again it was true that we could see a large number of individuals in a short time. We saw more than forty in the day that we were there. However, all of these except *two* were very large and presumably old adults. I talked about this with our boat captain and guide, Miguel Castro. He agreed that most of the Land Iguanas that he had seen on Barrington were large. Upon questioning, everyone who had any knowledge of the island agreed that practically all of the iguanas there were large.

Something, obviously, has greatly reduced the

normal reproduction of these lizards and they are as surely on the last leg of the route to extinction as though they were being systematically killed out. Our time on Barrington was much too short to provide a firm answer as to what is happening but two important factors are evident. One is that the herds of goats have consumed most of the green vegetation within reach of the lizards; the entire understory has been cleared up to a height of about six feet. In so doing they have reduced the cover for the lizards and made them more susceptible to predation. What the predators might be is unknown, but the Galapagos Hawk (*Buteo galapagensis*) is very common on the island, and it as well as gulls and frigate birds might pick up the young iguanas.

The other, and possibly correlated factor, is that of the native rat of Barrington, *Oryzomys bauri*. Ordinarily we do not think of one of the native animals becoming a hazard to the continued existence of the others, but such may be the case here. Several campers told me the story of their abundance. On the first night of a camp a few rats would appear but would remain rather shy. On succeeding nights, however, the local population would build up into unbelievable numbers and would become so aggressive that people found that not only their food but also their tent-ropes, sleeping bags, and even their hair and fingernails were being chewed while they slept. No one was able to remain at such a camp for more than three nights.

Such a situation is obviously not a normal one. Something has upset the balance of the population, allowing it to overrun its food supply. The goat, basically, may still be the problem. Perhaps in clearing out the vegetation it has also reduced the normal food of the rats. A possibility is that they have now turned to the eggs and young of the Land Iguana for a substitute.

The situation on Barrington brought to mind the situation on Baltra (= South Seymour) where the Land Iguanas have disappeared since William Beebe's visit in 1923. One point of his description in "World's End" caught my eye. In describing the large and apparently thriving iguana colony there he said, "Throughout all of our explorations of this colony I saw not a single lizard under twenty-four inches and most were

three feet and even more in length." Baltra was the site of a United States base during World War II and the disappearance of the Land Iguanas there was blamed on the activities of this base. Could it be that the iguanas were already gone, or there were only a few old survivors when the base was built? Although nothing was said of rats, certainly goats were there in abundance. Perhaps the state of Barrington today is similar to what Beebe found in Baltra in 1923.

We saw some scattered Land Iguanas on northern Isabela but did not reach the typical red-soil habitat of the lizards and cannot estimate their status. We also saw the colony at Conway Bay, Santa Cruz. Although our time there was short, it was notable that many of the burrows appeared to be empty and the only lizards we saw were large adults. It did not appear to be a thriving colony.

It was a rather sad experience to camp on Santiago Island, where Darwin had described Land Iguanas so thick that "we could not for some time find a spot free from their burrows on which to pitch our single tent." No iguanas at all were visible in the vicinity of James Bay; they appear to have been completely exterminated on the island. Whether it was the combination of man, goats, donkeys and pigs or some other

Dr. Dowling carries out the 80-pound tortoise discovered on Duncan Island — no easy load to carry for more than a mile over broken terrain and with the sun beating down on rough lava.

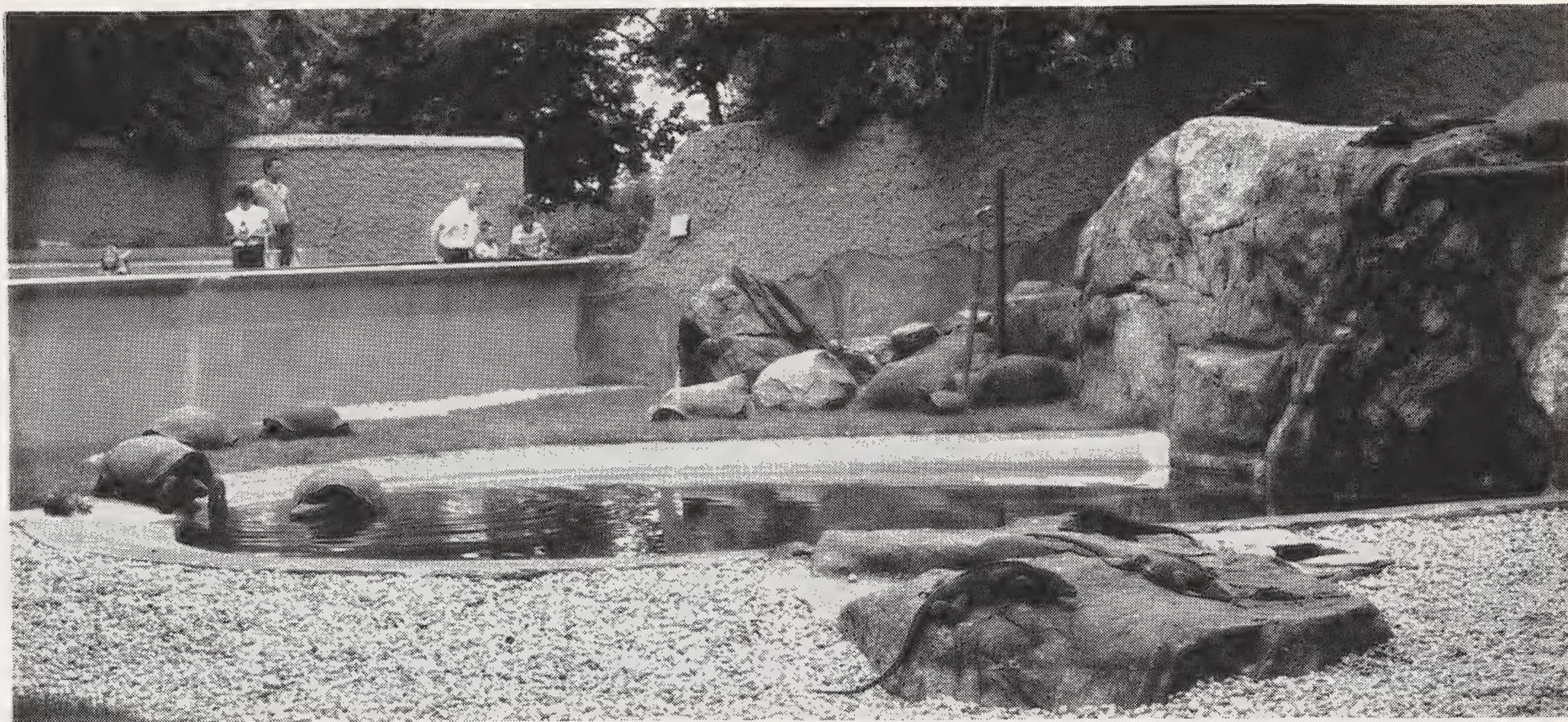
factor is unknown. But Santiago is an object-lesson in showing that Land Iguanas can, indeed, be eradicated from a large island.

The giant tortoises of the Galapagos are, like most of the animals, unique to the archipelago. Furthermore, each of the main islands had its own distinctive population (originally named as species but more recently recognized as races of a single species), that differ in shell structure, color pattern and over-all size and proportions. Eleven islands were inhabited by these tortoises when the archipelago was first known. Used as food staples for sailing ships, however, some were already extinct before 1840 and others have become so since that time. On some islands the tortoises were real giants; individuals on southern Isabela and Santa Cruz have been reported to weigh more than 500 pounds. Smaller races occurred on other islands; individuals on Duncan Island seldom exceeded 180 pounds.

Based on our own observations and the best local information that we could obtain, the present situation is this. Tortoises are now definitely known only from three islands: Santa Cruz, Duncan and Isabela. They may still occur on Fernandina, Santiago, Pinta and Hood, but none has been reported from any of these islands in the last five years. Only one has ever been found on Fernandina, that one in 1906. It seems quite possible that the entire tortoise population has been killed out on Fernandina by the many volcanic eruptions that have rocked it for its entire recorded history.

On Santa Cruz there is still a breeding popu-





We have an excellent place to display our collection of Galapagos giant tortoises and iguanas — the outdoor enclosure originally built in 1941 as the home of our Giant Pandas.

lation of tortoises. However, all three of the coastal localities where the females go to lay their eggs are known to fishermen who go there regularly to kill them for their meat and oil. When the number killed by fishermen is added to those killed by the new colonists in the highlands and the number of young and eggs eaten by feral dogs and pigs, it seems that the population has little chance of survival. The number of tortoises on Santa Cruz was estimated at 2,000 by the director of the Darwin Station, but a figure of less than 1,000 seems to me more realistic. The threat is unrelenting.

The Saddleback Tortoises of Duncan Island are almost extinct in their native habitat. We found a single ancient individual in our day's search of the eastern slope and the main crater of the island. Gary Knopf, who accompanied our party, found the remains of five individuals on a plateau just south of the crater. They appeared to have been killed by fishermen within the last year. Furthermore, records indicate that nothing but adult tortoises have been found here during the present century. The reason is plain to see. The presence of rat skeletons (*Rattus rattus*) broadcast over the terrain indicates that a huge population builds up during the rainy season, to starve to death at the onset of the dry season.

Since the laying season for tortoises comes at the beginning of the dry season, it is plain that the rats eat all of them before they hatch. The present tortoise population is estimated at fewer than fifty individuals, perhaps less than twenty-five. It is a miracle that any have survived under the conditions of this tiny island.

Tortoises still remain in fairly large numbers on the northern tip of Isabela. We found several young individuals at an altitude of about 800 feet, and the usual clutter of broken shells of female tortoises at a coastal laying area. The rough terrain has saved this population from extinction so far, but the constant attrition on the breeding grounds will ultimately lead to its annihilation.

We came back from this trip with increased knowledge and respect for the native fauna of the Galapagos, but with little hope for its future. The Darwin Station's censuses have merely made plainer the critical status of the animal populations. So far, at least, the Station's presence has been of negligible help in preserving those animals that remain. Some of the islanders are much interested in the native fauna and are, themselves, trying to promote its conservation. But they are few; most are interested only in the survival of themselves and their families. The recent resignation of the Ecuadorian Cabinet, again, stresses the fact that this country is faced with its own problems of survival and makes it unlikely that any considerable aid or expense can be devoted to the animal life of these isolated and rocky isles.

ZOO NEWS IN PICTURES

Photographs by SAM DUNTON

Staff Photographer



Here is picture proof of the complete recovery of the Monkey-eating Eagle whose fracture of both legs was reported in the last issue of *Animal Kingdom*. The bird appears to be its proud, imperious self in every respect except one — having gotten accustomed to human attentions during the period when its legs were splinted and it was immobilized in a sling, it now demands hand feeding by Keeper Bardsley.





Thomson's Gazelles are among the commonest of animals on the plains of Africa, but by no means equally common in the zoological gardens of the world, principally because they are so easily subject to parasitic infections. We are, however, having excellent success with our present herd of eight animals, the first we have exhibited. They include this agile youngster, born in the Zoological Park on July 31 and shown with its mother at the Antelope House.



Owls have a fascination for children (and adults!) and this young Spectacled Owl was a guaranteed success even before our Education Department incorporated it in the little menagerie it takes to New York City schools. Its tricks are few; usually it will incline its head to be scratched and sometimes it will say "Hoo" and clack its beak, but those simple actions seem to be enough to command attention. It is a hand-reared bird (probably brought up by Indians) and has been one of the features of our Animal Nursery all summer. Still in juvenile plumage, it will darken as it grows older, but retain the spectacles that contribute to its common name. The species is found from northern Colombia to Brazil.

Prince Juan Carlos of Spain and Princess Sofia came to the Bronx Zoo on an hour's visit early in September — and stayed two hours. Like any other visitors, they fed the elephants and enjoyed the Animal Nursery, where the Prince balanced the Sulphur-crested Cockatoo on his hand, and the Princess was delighted with "Mr. Moto," the baby Japanese Macaque. With them in the Nursery were Herbert Knobloch, Associate Curator of Education; Miss Michele Perrault and Miss Katherine Efthimion, attendants at the Nursery.



The outstanding feature of these Blue Parrot Fish (*Scarus coeruleus*) seems to be their unusual profile, but when seen alive their color is most eye-catching — a robin's egg blue so intense the fish appear to be lighted from within. Last July Dr. Clay Frick collected this delicate species for the Aquarium. Swimming nearby are two Palometa.





Easy-going Giants --

Two Square-lipped Rhinoceroses Come to the Zoo

By WILLIAM BRIDGES

Curator of Publications

IF THE SHIPPING CRATE is strongly built (and it almost always is), the arrival at the Zoological Park of even the largest and most powerful animal presents no problem — up to a point. The truck rolls through the gates, men and machinery take over, position the crate; a hasty conference assesses all possible follies the beast may commit as it emerges.

Then the crate's door is lifted or swung open. You wait, expecting the worst, the best, or something in between.

You seldom get the best, which is simply a

slow, calm, unhurried, unfrightened emergence of the animal from the box that has been its familiar home for days or weeks. Sometimes it comes out fighting and crashes blindly into bars or fence. It *can* break a leg or its neck. That is the worst.

The best happened on September 4 when Malamba and Qagaza came to the Bronx Zoo from Zululand. They are Square-lipped Rhinoceroses (sometimes called White Rhinoceroses) and the first we have ever exhibited. The African Black Rhinoceros we know and respect, and we have

long acquaintance with the great Indian Rhinoceros. By all accounts the Square-lipped is not particularly aggressive, as a species, but there is no accounting for individuals and there was no telling in advance how 1,900-pound Malamba, the male, and 2,800-pound Qagaza, the female, might take to the sights and smells of a stall 25 feet by 25 feet.

They took to it with mild curiosity. A crane with a 100-foot boom lifted Qagaza's crate first and set it smoothly in the doorway of the stall in the northwest corner of the Elephant House. Qagaza was on her feet but standing like a rock as keepers knelt on top of the crate and loosened the bolts that held barrier bars in place just inside the crate's swinging half-doors. The underpinning of the bars was wrenched away and the bars removed, the doors opened. Qagaza just stood there.

ages in the capture of a Square-lipped Rhinoceros at the Umfolozi Game Reserve. Left — A tranquilizing drug has taken effect and the animal can be walked into the crate. Right, top — It is even calm enough to allow itself to be measured. Center — The crate is loaded on a truck. Bottom — In the corral.

Satour—South African Tourist Corp. photos

She was so obviously not frightened or aggressive that keeper patience wore thin after five minutes. From the top of the crate a broomhandle prodded her rump. She backed up.

Everyone waited, and in another five minutes Qagaza put out one foot tentatively and stepped down eight inches onto the floor of the stall. She came the rest of the way and the men on top of the crate let the half-doors swing shut behind her. Keeper Montana tossed an armload of alfalfa onto the floor and Qagaza began to eat. She explored, found the watering trough and had a leisurely drink. Just as unconcernedly she walked through the connecting door into the adjoining stall and allowed herself to be locked in while the same transfer from crate to stall was accomplished for Malamba. He was even less coy and strolled out of his box in four minutes.

Later that afternoon the two animals were allowed to be together for five minutes. Wild-caught a month before, they had never seen each other and had not been with others in captivity. They sparred a bit with their horns, kept a wary





eye on each other (neither seemed to want the other to get behind it), and then they were separated for the night. The next day they ran together in the outside corrals, and since then they have been together every day and lost all wariness of each other; of people they apparently had little or none from the beginning. Qagaza had been out of her crate less than 15 minutes when General Curator Emeritus Crandall offered her a bouquet of long-stemmed grass and she took it from his hand.

The story of their capture on the Umfolozi Game Reserve in Zululand has already been told in a Newsletter to Members of the Zoological Society, but for the record it can be briefly summarized here. In February the Natal Parks, Game and Fish Preservation Board wrote to the Society offering to sell a pair of Square-lipped Rhinoceroses for three thousand pounds sterling, or about \$8,400, explaining that the Reserve was overcrowded and that the animals were endangered by increased human pressure on the periphery of the reserve. Some Square-lipped Rhinoceroses were being shipped to other areas in South Africa,

A crane with a 100-ft. boom was waiting at the Zoological Park to lower the heavy crates down to a stall door in the Elephant House. Nothing disturbed the rhinos during moving.

and they were being offered to some zoological gardens that might be expected to breed them.

We jumped at the chance to get this magnificent southern form of the Square-lipped Rhinoceros (*Ceratotherium simum simum*), and since the Catskill Game Farm in Greene County, N. Y., and the San Diego Zoo also wanted a pair, we arranged for Harry Overbaugh to fly to Natal, assist in the capture, and bring six animals to New York. Mr. Overbaugh, as foreman of the Catskill Game Farm (which is operated by Roland Lindemann, the Zoological Society's Consultant in Mammal Management), is abundantly experienced in handling big animals and we expected the venture to be just as uneventful as in fact it was. The Umfolozi Game Reserve people scouted for rhinoceroses in a Land Rover, chased them until they were near enough to fire a drug-loaded syringe, waited until the rhinoceroses went

down under the influence of the drug, and then got them into crates and carried them to holding pens at the Reserve. In the days before tranquilizing and soporific drugs and the technique of injecting by a gun-propelled syringe, the capture would have been long and dangerous to men and animals; today it is quick, sure and harmless to all concerned.

THERE are two races of the Square-lipped Rhinoceros in Africa: the southern, found only in the Umfolozi and Hluhluwe Game Reserve and adjoining state-owned lands and native reserves, and the northern *Ceratotherium simum cottoni*, which has a much larger range in Uganda, the Congo and the Sudan. The latest official count gives about 600 individuals of the southern race in an area of some 212,000 acres — half of them crowded into 92,000 acres. In a large part of the Umfolozi Game Reserve there has been at least one Square-lipped Rhinoceros per square mile, and for short periods as many as 30 to 42 per square mile.

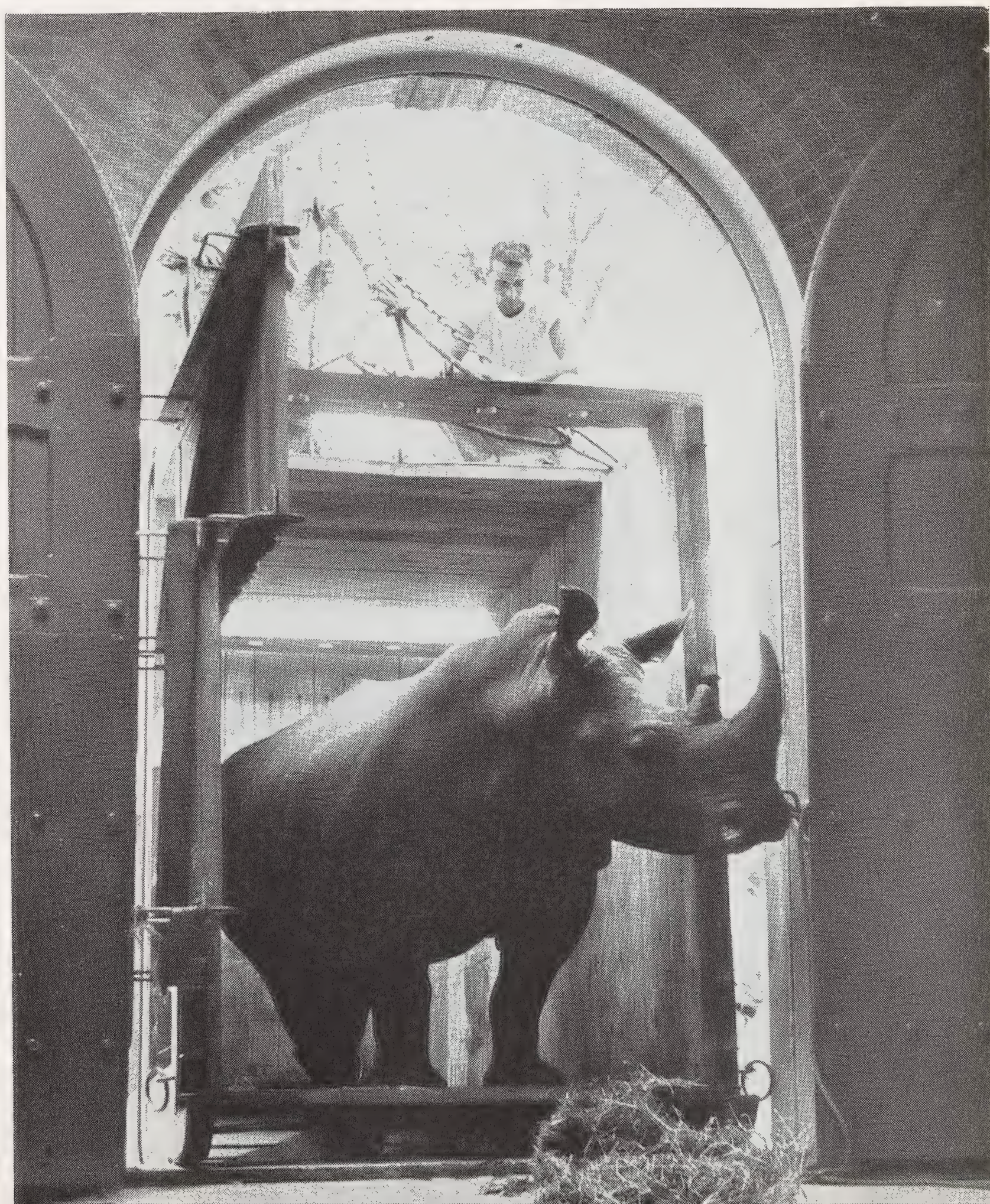
Unlike the Black Rhinoceros of Africa, which is a browsing animal, the Square-lipped is a grass-

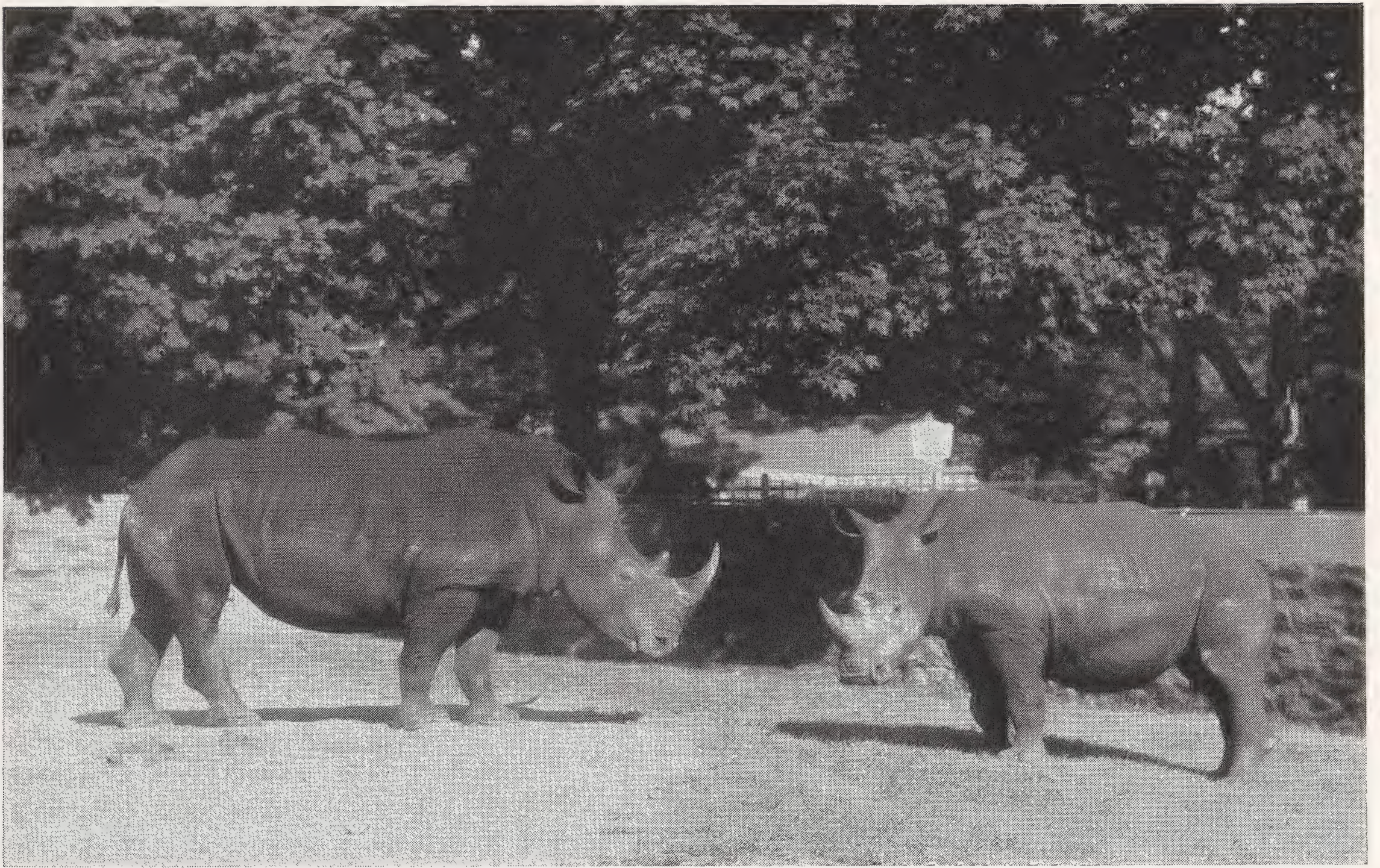
feeder and it naturally takes a good deal of territory to support a large population. It is, indeed, the largest land animal next to the elephant and the weight of a big adult is about four tons, although three tons is average. The largest specimens on record stood six and one-half feet at the shoulder and the longest horn in the southern race was 62 $\frac{1}{4}$ inches. The usual length, however, is between two and three feet and the posterior horn is always much shorter than the anterior.

Square-lipped Rhinoceroses have a poor sense of hearing and sight, but a keen sense of smell. They have the advantage, however, of usually being accompanied by Red-billed Oxpeckers which have excellent sight, and whose flight and cries of alarm warn them of approaching danger. When a group of rhinoceroses is alarmed by the birds, the big animals stand up in an alert posture, heads outward and facing in different directions. If the danger seems imminent, they charge away from it. Unless they have been severely harassed by hunters, they are not aggressive toward human beings and in the Umfolozi region there is only one record over many years of a man being gored by one — and even that record is doubtful. There

The swinging doors of the heavy shipping crates were opened and for a few minutes the rhinoceroses surveyed their new home — and then, calmly, they emerged.

Landau—UPI Photo





is a record of a Square-lipped Rhinoceros apparently wantonly charging a truck, but it was seen to shy away from the vehicle when it was six feet away and the conclusion was that the animal's sight was so poor that it did not realize what it was running into.

All accounts tell of the animals' delight in wallowing in mud or water. We have noticed that they like to pitch up in the shade of the Elephant House and lie or stand out of the sun for long periods. In the Umfolozi, water turtles have been seen congregating around wallowing rhinoceroses and eating the ticks on their bodies.

We do not know enough about the reproduction of the Square-lipped Rhinoceros to forecast the possibility of our animals producing offspring. The male is presumably about $2\frac{1}{2}$ years old, the female about 4 years. We do know that they usually have one calf at a birth, after a gestation period of about 16 months. There are many stories of the strong attachment between the calf and its mother — such as incidents of a cow rhino being killed and her calf standing by her side, driving off jackals and vultures, until it succumbed to starvation. Calves make a squeaking noise when they are lost or frightened, and adults puff, snort and make a variety of loud sounds.

The second day after the Square-lipped Rhinoceroses were in the Zoological Park, they were turned out in their big yard at the Elephant House. They seemed only a little wary.

Since seeing Square-lipped Rhinoceros in the flesh, the alternative popular name of "White Rhinoceros" is all the more puzzling. The "White Rhinoceros" is actually so dark that it could well be called black — whereas the so-called African Black Rhinoceros, *Diceros bicornis*, is unmistakably strongly brownish in coloration!

Many theories have been advanced as to why the animal is popularly known as the White Rhinoceros — that the first animals seen by hunters and explorers had been wallowing in whitish clay, for instance. Boer hunters are said to have called it "Witrenoster" in Afrikaans — translated as White Rhinoceros. But why they chose that name is unknown. In any event, the "White" Rhinoceros certainly is not white, and we are using the more descriptive name of Square-lipped Rhinoceros.

It will, as time goes on, be interesting to see what their names of Malamba and Qagaza (bestowed by the Umfolozi officials) become in the daily usage of keepers and public!

The Woodcreepers of Tropical America

By ALEXANDER F. SKUTCH

San Isidro del General, Costa Rica

IN THE MILLIONS OF YEARS that birds have inhabited the earth, they have become adapted to occupy every habitat that can support warm-blooded, air-breathing vertebrates, and to exploit almost every source of food available to animals of their size and strength. Some, such as the penguins, spend almost their whole lives swimming and fishing in the sea, coming ashore only to nest. Swifts pass their days catching insects high in the air. Most birds are more closely associated with vegetation. Many of these subsist largely on fruits; and many others, such as warblers and vireos, are well fitted to glean insects from foliage. Woodpeckers have many anatomical peculiarities that equip them for extracting insects from deep in the wood of trees.

A special foraging niche which vegetation offers to birds is the bark of trees, in the crevices of which many small insects and spiders live. The profitable exploitation of this food demands special capacities. Although numerous small birds of diverse families occasionally glean from the bark, few birds make this their major occupation. In temperate North America, the chief bark-foragers are the nuthatches, the Brown Creeper and the Black-and-White Warbler, an aberrant member of its family. The nuthatches have short, rounded tails and can run over upright trunks in any direction, clamping themselves to the bark with their feet. The creeper has a relatively long, pointed tail which serves as a prop as it ascends tree trunks in an upright position, often spiraling

around them, while with its slender, curved bill it extracts small invertebrates from the crevices.

In the Western Hemisphere, nuthatches extend southward only as far as Mexico, while the Brown Creeper reaches Nicaragua. In the tropical portion of their range, these birds of cooler regions stay in the highlands. Thus they hardly begin to exploit the trunks of the countless millions of trees of tropical America. Throughout continental tropical America, the chief bark gleaners are the approximately 60 species of woodcreepers or woodhewers (*Dendrocolaptidae*), a family of birds which has failed to reach the West Indies,

The valley of El General in Costa Rica, where the author makes his home. It is in such fire-killed trees as those on the slope at the left that Streaked-headed Woodcreepers nest.

Photo by the author



or to spread much beyond the tropics. These birds superficially resemble the creepers of the family Certhiidae, a fact which impressed me in the highlands of Guatemala, where I sometimes watched a Spotted-crowned Woodpecker and a Brown Creeper hunting over the same trunks in much the same fashion. But the creepers of the north and the woodcreepers of the tropics are not closely related. The former are true songbirds, whereas the latter belong to the branch of the passerine order which is considered more primitive because of its simpler vocal apparatus. Woodcreepers are related to the American or "tyrant" flycatchers and to such tropical families as the ovenbirds, antbirds, manakins and cotingas.

In size, woodcreepers range from about 5 to 13 inches, or from the length of a Brown Creeper to that of a flicker. Brilliant coloration is quite lacking in the family, all of whose members are clad in shades of brown and olive, which are often brighter and richer, more chestnut or rufous, on the wings and tail than on the body. Many species are conspicuously spotted or streaked with lighter and darker shades, especially on the head, neck, shoulders and breast. Woodcreepers' bills range from short and wedge-shaped to very long, slender, and downcurved, as in the scythebills. These long bills are excellent instruments for probing for insects among clusters of palm fruits or between twisted lianas. The feet of woodcreepers have three toes directed forward and only one backward, instead of two forward and two backward as in the woodpeckers. Especially noteworthy is the woodcreeper's tail, consisting of 12 long, graduated feathers with stiff shafts whose tips project beyond the vanes and are turned inward, the better to engage the bark and support the bird. Woodcreepers commonly maintain an upright position as they work up vertical trunks, although as one hunts outward along a drooping branch it may assume a horizontal and then a somewhat inverted posture. After following one trunk upward as far as the hunting is profitable, the woodcreeper usually flies down to near the base of another and repeats the process.

Woodcreepers seem not to eat vegetable matter but subsist largely on the insects and spiders which they find in crevices in the bark or beneath tufts of moss or lichens, which they lift up or pull off to see what lurks beneath. They some-

times pry off loose flakes of bark but only rarely do they dig into soft, rotten wood for insects. They may vary their diet with small frogs and lizards, and this is especially true of the short-billed dendrocinclas. These middle-sized woodcreepers frequently forage with army ants, along with a variety of other birds. They cling low on the tree trunks while they watch for small creatures that the hunting ants drive from concealment, then dart down or out to snatch up the fugitives. The big Barred Woodcreeper likewise accompanies the army ants.

The calls of woodcreepers are among the notable sounds of the tropical American forests. Some repeat loud, stirring cries, which exasperate the bird watcher because he thinks that a bird that makes so much noise should be easy to see, and he cranes his neck in vain for a glimpse of the brown bird clinging to a trunk amid screening foliage. Other woodcreepers have clear, melodious trills. The Brown-billed Scythebill's vocal performance never ceases to excite my wonder, for he seems to sing two songs simultaneously. To a fine, clear, ascending trill he adds a loud, ringing *tewe tewewe tewewe tewewe we we we we we we*; and how he can carry the second tune without dropping the first I fail to understand.

To the student of tropical birds, woodcreepers are a standing challenge. In the first place, the uniformity of coloration throughout the family makes many kinds difficult to identify; one must rely heavily on shape of bill, voice, size and habitat to supplement plumage pattern as aids in identification. Secondly, woodcreepers' nests are exceedingly hard to find, and usually also to reach if they have been discovered. Although sometimes these birds will deign to occupy an old woodpecker's hole with an obvious round doorway, they prefer a natural cavity in a tree, and the smaller and less conspicuous the entrance, the better they like it. Moreover, hammering on the trunk will not always make an incubating or brooding woodcreeper look out through its doorway and reveal that it has a nest.

About our house in Costa Rica, and among the shade trees of the coffee plantations, the most common woodcreeper is the Streaked-headed Woodcreeper, *Lepidocolaptes souleyetii*, a middle-sized species which, unlike many others, prefers light woods and clearings with scattered trees to

heavy, unbroken forest. As they climb up the trunks of neighboring trees, the male and female, who remain mated throughout the year, often call to each other with long-drawn, clear trills, all in the same key. I can detect no difference in the responsive songs of the male and female, who wear the same streaked brown plumage, so that they provide no clue to their sexes.

Woodcreepers become active very early in the morning and are among the last of the diurnal birds to retire at nightfall. Long after ease-loving woodpeckers have ensconced themselves in their neatly carved holes, the woodcreepers seek the irregular crannies where they sleep. The light is then so dim that it is often difficult to distinguish their dark forms from the dusky trunks up which they climb, but over the years I have traced many Streaked-headed Woodcreepers to their lodgings. The cavity chosen for roosting is usually well above the ground in a trunk or branch. Sometimes it is the end of a hollow stub with an upwardly directed opening that permits rain to enter. I have known woodcreepers to sleep in such roofless chambers in the wettest weather, despite the apparent availability of covered woodpecker holes nearby. Evidently concealment is more important to the sleeping woodcreeper than dryness. Like other species of woodcreepers on which I have information, the Streaked-headed always roosts alone. One evening, when one of these birds tried to join another, doubtless its mate, in the dormitory, both flew out. Then I thought I saw one return to the crevice, but the light was now so dim that I may have been mistaken.

Early in March, the Streaked-headed Woodcreepers begin to carry material into the high hole which, after much cautious exploration, they have chosen for their nest. Usually it is a natural cavity in a living or dead tree, but exceptionally it is an abandoned hole of the Golden-naped Woodpecker. The entrances to the occupied nests that I have seen ranged from about 80 to 15 feet above the ground, but low sites are exceptional. The actual nest may be several yards below the orifice. The male and female share the work of building the nest, which is a loose accumulation of pieces of hard or corky bark, up to three inches in length and sometimes even larger. The woodcreepers pull these flakes from trunks

and branches, often tugging vigorously to detach them. When working together, they call to each other with their delightful trills, but one building alone is usually silent.

The few nests whose contents I could learn contained two eggs or nestlings. As usual in the woodcreeper family, the eggs are pure white and the two ends are about equally blunt. Some years ago, a Streaked-headed Woodcreeper with a conspicuous patch of whitish feathers on its nape frequented the trees around our house and nested in a tree that shaded the neighboring coffee grove. This abnormal bird was mated to a normal one with a brown nape. At last I had a pair of woodcreepers whose members were distinguishable, so that I could learn how much each contributed to rearing the brood. There remained the problem of learning which was the male and which the female. Since the normal bird occupied the nest by night, and among passerines this is as a rule the female's role, I concluded that White-nape was the male.

It soon became evident that the female was doing most of the incubation, even by day. In 15 hours of watching, she took 13 sessions on the eggs, ranging from seven to over 72 minutes and averaging 37.5 minutes. White-nape sat only three times, for intervals of 15, 28, and 42 minutes. Often one partner flew away before the other came to relieve it, with the result that the eggs were left unattended for 14 periods, ranging from 2 to 41 minutes and averaging 21.2 minutes. In the following year, I did not discover White-nape's nest, but two years later he again undertook to rear a family in the coffee plantation, close to his earlier nest. This time he was much more attentive to the eggs, in the course of a day sitting eight times, while his mate, who may well have been the same one that he had two years earlier, took 11 sessions. He was in the nest for a total of 138 minutes, she for 300 minutes, and the eggs were left alone for 288 minutes. Actual incubation was even less constant than these figures indicate, for the parent in the nest often climbed up to look out with its elfish head in the doorway, sometimes remaining there for as long as ten minutes at a stretch.

The woodcreeper coming to take its turn at incubation often brought a flake of bark for the nest, and less frequently it carried a piece away



Left — This drawing of a Streaked-headed Woodcreeper is not turned on its end; this is the way the bird creeps up the side of a tree. Right — Gaunt, dead trees in the clearing are used for nesting and roosting.

Drawing and photo by the author

when it flew off to forage. On one occasion, the female left with a flake as her mate arrived with another flake. Thus the materials of the nest were constantly changing, yet the accumulation grew, for more pieces were brought than were carried away. Such continued preoccupation with nest materials during incubation is characteristic of woodcreepers and the related ovenbirds, as likewise of cotingas and hummingbirds.

I could not determine the incubation period at this inaccessible nest. But some years earlier, a pair of Streaked-headed Woodcreepers and a female Tawny-winged Dendrocincla, *Dendrocincla anabatina*, competed for a hollow palm stub as their nest site. The two kinds of birds built alternately, and finally two white eggs were laid. Then the lone dendrocincla, a belligerent bird, drove away the timid Streaked-headed Woodcreepers and proceeded to incubate. One of the eggs hatched in 15 days. When the nestling, attended solely by the dendrocincla, was old enough to be identified by its plumage and voice, it became evident that the dendrocincla had hatched and reared her rivals' offspring. Inci-

dentally, she provided me with my only determination of the incubation period of the Streaked-headed Woodcreeper.

Newly hatched woodcreepers are typical passerine nestlings with sparse down that fails to cover their pink skin, and mouths that are yellow inside. White-nape's mate gave more time to brooding the nestlings than he did, just as she had incubated more assiduously. But the two parents were about equally active in bringing food. Fifteen days after the eggs hatched, each parent came with food 16 times during four hours of the morning, so that the two nestlings were fed at the rate of four times per capita per hour. On each visit, the parent brought a single insect, held conspicuously in its slender bill. Usually the insect's color was brown, suggesting that it had been plucked from the bark rather than from foliage, and it had very long antennae. When the nestlings were quite young, the parents always entered the hole to feed them. After the nestlings were feathered and could look through the doorway, their meals were passed to them from the outside.



Corresponding to these changes in the method of delivering food were changes in the attention devoted to sanitation of the nest. When the nestlings were newly hatched, I saw the parents carry out no waste and inferred that the droppings had been swallowed by them. Later, a parent often left with a white sac in its bill. But after the adults no longer entered the nest to deliver meals, they quite neglected sanitation. Apparently the bottom of the chamber was becoming foul with droppings, but this probably did not incommode the nestlings, who spent much, if not all, of their time clinging to the walls of the chamber.

When the nestlings were about 15 days old, I sometimes saw two streaked brown heads in the doorway. In their juvenile plumage, they closely resembled their parents. They now often uttered, chiefly at mealtimes, a trill which resembled that of the adults but was weaker and less melodious. Eighteen days after I first noticed the parents taking food rather than bark into the hole, it was empty, the young having flown. Possibly they were in the nest at least a day longer, for 19 days was the age of departure of the Streaked-headed Woodcreeper reared by the dendrocincla in the low nest into which I could look. After the young woodcreepers flew, neither they nor their parents returned to sleep in the nest.

Two years later, when White-nape again nested in the coffee grove, he vanished soon after the eggs hatched. A few days after his disappearance, a second, normally colored, adult arrived, and it seemed that the female had acquired a new mate who was helping to feed the young. But before I could confirm this, the doorway was enlarged by some predator and the nestlings vanished.

The little coffee grove where the Streaked-headed Woodcreepers nested has been for the last three years the home of a Tawny-winged Dendrocincla. In three successive seasons she has nested in old woodpecker holes in a dying avocado tree, and between breeding seasons she has slept there.

In sharp contrast to the Streaked-headed Woodcreeper, this related bird always builds her nest, incubates her eggs, and rears her young quite alone, with never a mate in view, as I have seen also with other individuals of the species. Her nest is composed of strips of fibrous bark and whitish foliaceous lichens, and with these materials her two white eggs are often more or less covered while she takes a recess from incubation. Last year, when I was able to determine the incubation period quite accurately, it was between 20½ and 21 days.

The young remain in the nest for 24 days, or some five days longer than Streaked-headed Woodcreepers, although the two species are about the same size. Small lizards enter prominently into their diet, and I have seen a brood of two receive seven in the course of a morning, in addition to insects. Although through most of the day the usually substantial meals are brought infrequently, the rate of feeding sometimes becomes very rapid in the evening twilight, after most birds have gone to rest. In the fading light, the dendrocincla catches flying insects on swift, graceful darts from the trunk to which she clings. One evening she gave her two nestlings 13 insects and one lizard in a little over half an hour. She kept the nest clean as long as the young remained in it. In contrast to the loquacious nestlings of the Streaked-headed Woodcreeper, the young dendrocinclas were always discreetly silent. After the departure of one brood, the two fledglings slept in neighboring hollow trunks, always alone, while their mother roosted in her usual hole in the avocado tree.

CONSERVATION



Martha Munzer

Martha Munzer was the second woman to receive a degree in electro-chemical engineering from the Massachusetts Institute of Technology when she was graduated in 1922.

As Education Assistant to the Foundation Martha is a tower of strength. She has carried out three major assignments for us, all resulting in publication. The first was a critical analysis of conservation textbooks currently being used in American High Schools. The second was the preparation of the McGraw-Hill textbook, "Teaching Science Through Conservation," of which Paul Brandwein was co-author. Her latest book, for teen-agers, "Unusual Careers," was published by Knopf in April. She is currently working on a new book tentatively entitled "Ourtown—Today and Tomorrow," also for young people, which will be published by Knopf in 1963. Among other assignments for the Foundation was the major role in preparation of evaluation instruments entitled "Tests of Reasoning in Conservation," in cooperation with the Educational Testing Service of Princeton, N. J. These tests are now being given to High School students in many parts of the country.

Mrs. Munzer has five grandchildren, a home in Mamaroneck, New York, and a compulsive desire to go swimming while less red-blooded types are huddled close to the fireplace. Martha

FOUNDATION

Munzer would be the first to tell you that the scientific equation for energy is $E=mc^2$, but she would be guilty of telling a half truth. The equation for energy is Martha Munzer, period.

Latin American Reconnaissance Study

The Foundation is undertaking a three months' survey of conservation progress in Latin America. It includes a review of activities and needs related to available water, soil conservation and forestry management on a sustained yield basis. It will also include the study of national park establishments, wild-life conservation and the interrelationships of these factors.

Dr. William Vogt, who made six studies in Latin America for the Pan American Union in 1943, will interview heads of international and local organizations concerned with recent development activities in the area, and make wholly new field observations.

Faculty Seminar on Natural Resources

The Foundation has made a grant to the University of Massachusetts to conduct a Seminar on Natural Resources, focused on the examination of the new Massachusetts Town Conservation Commissions. These have been established as a democratic device whereby local communities exercise greater control and direction over the planning, management and utilization of local natural resources. The goal of the seminar is to stimulate university research and the development of extension programs dealing with the environmental and natural resource aspects of community development.

Briefly Noted

Stephen W. Blodgett has been appointed for a three-year term to the Advisory Committee on Conservation of the Garden Club of America . . . Martha Munzer spoke in Trenton to the New Jersey Resources Education Committee on "What's New in Conservation Education."

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

“Our Crowded Planet” Edited By Dr. Osborn

A selection of essays on the pressures of overpopulation has been gathered together under the title “Our Crowded Planet” and was published in mid-August by Doubleday. It was edited and has a preface by Dr. Osborn.

The book is divided into five sections: Population Pressures on Man’s Natural Environment; on Economic and Political Trends; in Specific Areas; The Population Problem and Religion; and Population Pressures on Morals and Ethics.

Contributors include Eugene R. Black, noted economist; Lord Boyd Orr, food expert and Nobel prize winner; Sir Charles G. Darwin, who views the population explosion as an expression of biological laws; Arnold J. Toynbee, Sir Julian Huxley and André Maurois. The views of the Church are represented by a Catholic, Father Robert I. Gannon, and an Episcopalian, Bishop James A. Pike.

The authors were given no indication of what kind of response would be welcome. They were invited to comment on the premise “that the worldwide significance of steadily increasing population pressures on all phases of man’s environment and future well-being is too little understood.” The price of the book is \$3.95.

Angling in the Aquarium But Under Official Auspices

An oft-repeated subject for cartoon or comic strip is the kid who tries to go fishing in a public aquarium. The joke soon gets pretty stale to an aquarium man, especially when various acquaintances keep asking, with pointed jocularly, for permission to angle in his tanks. This summer, however, we had occasion to permit some angling in one of our tanks, and solved a ticklish problem by doing so.

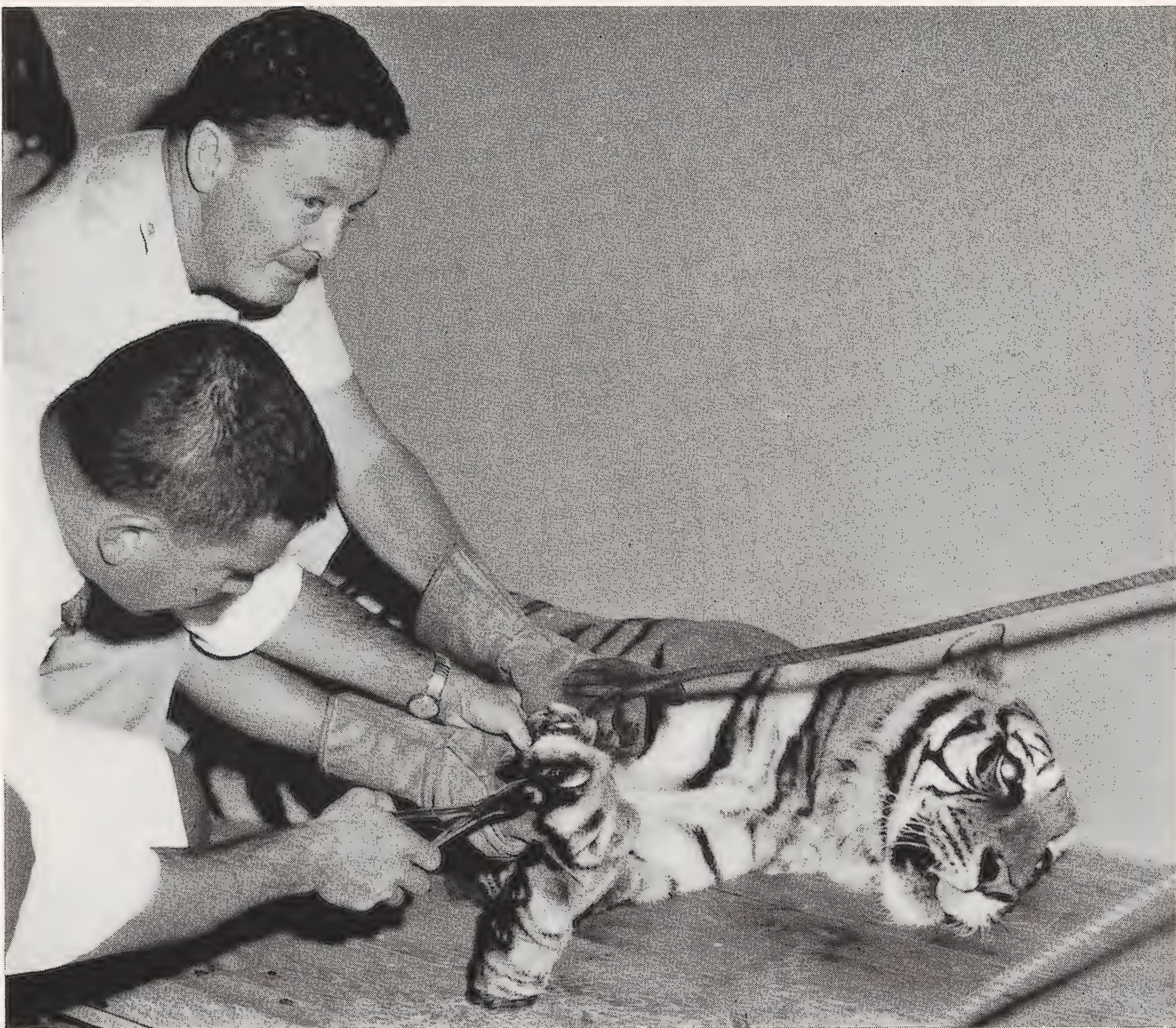
The problem was to remove a school of Pal-

ometa (*Trachinotus glaucus*) that were overcrowding an exhibition tank that also contained parrot fishes, tarpon and other piscine showpieces. Palometa are handsome, silvery fish, always on the move, dashing and flashing back and forth across the front of the tank — much too fast and “nervous” to be caught in an ordinary hand-net. Moreover, they are an excellent exhibition fish, and we did not want them to suffer any net-burns or other injury, as would undoubtedly have happened if we had tried to net them in the large, open tank. Ordinarily under such circumstances, we would lower the water to a foot or so, and then, having the fish in a more circumscribed area, would be able to maneuver them into containers or fixed nets wrapped with shielding cheesecloth. In this case, however, the parrot fishes were a complicating factor. They were newcomers and most likely would have become frightened at any sudden shrinking of their environment, and because of their large size would have seriously hurt themselves trying to escape.

At this point, Tankman Edward Dols, who is a skilled angler of wide experience, suggested that the Palometa might be removed by catching them on hook and line. This, he assured us, could be done without injuring them. Since no one could think of a better solution, Dols was told to go ahead with his unorthodox plan. He starved the fish for a day and after “chumming” them with a few pieces of clam, he fished for them with a #1 hook from which he had filed the barb. In 20 minutes Tankman Dols caught 19 of the 21 Palometa in the tank. So gently was he able to handle them and so little did they mind the hook that they fed again practically as soon as they were released into a reserve tank. — JAMES W. ATZ.

At National Parks Conference

Dr. Carleton Ray, Associate Curator of the Aquarium, attended the World Conference on National Parks in Seattle and spoke on “Aspects of Inshore Marine Conservation,” pointing out



Overgrown claws on her left forefoot have been bothering old Dacca, our Tiger mother, for some time. In September she was immobilized by an injection of succinylcholine and during the 7 minutes she was under its influence, Dr. Gandal cut the claws back. Now she walks easily.

the urgent necessity of setting aside unspoiled shores with their adjacent waters as land-and-sea parks. The response to his talk was so favorable that he and Peter Scott, the British conservationist, were asked to help prepare a resolution — eventually adopted by the conference — calling to the attention of all maritime nations the need for establishing marine parks and reserves.

European Zoo Men Here

Several European Zoo men, in America to attend the meeting of the International Union of Directors of Zoological Gardens in San Diego in October, passed through New York in late September and visited the Zoological Park. At the

time of going to press, we had had visits from Dr. Heinz-Georg Klos of the West Berlin Zoo; Dr. Jacques Nouvel of the Paris Zoo; Dr. Ermanno Bronzini, Rome Zoo; Franco Cuneo, Naples Zoo; and Walter van den Bergh, Antwerp Zoo. Many others were expected either on their way to the meeting, or following it.

From Bermuda's Coral Reefs

Seventy-eight specimens of marine fishes and invertebrates, of 20 species, have been received by the Aquarium from Bermuda waters. They were captured especially to fill gaps in the collection, through the good offices of Dr. Clay Frick, a trustee of the Zoological Society, who has made

possible the acquisition of many valuable Aquarium exhibits. Dr. Frick was aided by his family and several other friends of the Society, including H.E. Sir Julian Gascoigne, Governor of Bermuda, and Lady Gascoigne; Louis Mowbray, Director of the Bermuda Government Aquarium; Campbell O'Connor, captain of Dr. Frick's motorsailer *Rockfish*, and Messrs. Donald Barwick and John Trimmingham. The most outstanding fishes were several parrot fishes and groupers weighing 20 to 40 pounds, a rare False Filefish, and two Blue Parrot Fish, a gorgeous species that is notoriously difficult to handle.

The Death of "Seeku" at the Aquarium

"Seeku," the Aquarium's young male Pacific Walrus, was found dead in his pool on the morning of August 23. His death came without warning; the day before he had eaten his usual 20 quarts of special formula (40 pounds of clams and two quarts of heavy cream) with his customary gusto and had spent most of the time playing vigorously with his walrus companions, "Ookie" and "Tipuk." His growth had been excellent; in fact, he had gained 610 pounds since his arrival at the Aquarium as a 145-pound baby hardly a month old in May of 1961.

In order to perform the most complete autopsy possible, the Aquarium joined forces with the Department of Pathology of Beth Israel Hospital. The detailed results have not been completely analyzed by Dr. Ross F. Nigrelli, the Aquarium's Pathologist, and Dr. William Antopol, Pathologist in Chief of the Hospital, but the presence of a stomach ulcer and other lesions indicates that "Seeku" died of a blockage of the digestive tract. This was undoubtedly caused by the coins, paper, sticks, bits of plastic and other foreign objects found in the stomach.

One guardian had always been assigned to the Polar Bay where "Seeku" was exhibited, to keep visitors from throwing trash in the pool, but after the animal's death the guard was doubled. Large signs, reprinting the *Herald Tribune's* account of the tragedy under the headline "Murdered by Litterbugs" have been put up in the Aquarium and around the Polar Bay.

IN BRIEF

Aquatic Demolished. The Aquatic Bird House — first building opened in the Zoological Park in 1899 — has been demolished to make way for the new home for aquatic birds that will rise on its site during the winter. Demolition started at the very end of July. The Flamingo collection, normally housed in the building during the winter, was moved to temporary quarters in the Ostrich House. There will be four major habitat displays in the new building with no barrier between the public and the birds. Among other innovations are a closed-system television patrolling system, a tree-top display and an aquarium-like exhibit. The entire paddock system adjacent to the Aquatic Bird House will also be redeveloped.

Aquarium Winter Schedule. Until Memorial Day next spring, the Aquarium will be closed to the public on Mondays and Tuesdays, except when a holiday falls on one of those days.

Sudana Is Gone. Sudana, our largest African Elephant, was euthanized on August 11 after she developed severe arthritis, went down and was unable to stand. Born in 1927, she came to us on November 9, 1931. She weighed 9,670 pounds at death.

PUBLICATIONS OF INTEREST

TROPICAL FISHES AS PETS. By Christopher W. Coates. 188 pp., 16 photos. Collier Books, N. Y., 1962. \$.95.

Any hobby book that sells nearly half a million copies has got to be good. Director Coates' book on home aquaria has done just that. Now it is back in print once more, as an attractive, economically-priced paperback.

I TALK TO ELEPHANTS! By Myra Cohn Livingston. Photographs by Isabel Gordon. 48 pp. Harcourt, Brace & World, Inc., New York. 1962. \$2.50.

Last summer Mrs. Gordon brought two small children to the Bronx Zoo and over several weeks introduced them to more than a score of animals. Her photographs catch expressions that range from solemn wonder to high glee, and Mrs. Livingston's brief, rhythmic, simple text says just what small children *would* say when they talk to elephants and monkeys and giraffes and reindeer and turtles. This is a happy book to read to imaginative beginners.

REPTILES IN THE HOME ZOO. By Isabel Hoopes. vi + 58 pp., illustrated. Boston: Pub. Museum of Science, 1962. \$1.50.

This revised edition of a 1936 publication gives a considerable amount of needed information on the care of pet reptiles. Its contents on the selection of pet species, the preparation of cages and the general care of reptiles in the home are well presented and helpful. The booklet fills a definite need in these areas. More

detailed information on food preferences, temperature needs, and especially diseases would have made it much more valuable to its intended audience. — H. G. DOWLING.

New Natural History Paperbacks

The flood of inexpensive paperback reprints of books that have been popular for reference or general reading in a broad natural history field shows no sign of abating. Some recent ones are:

Dover Publications, New York

American Wildlife & Plants: A Guide to Wildlife Food Habits. By Alexander C. Martin, Herbert S. Zim and Arnold L. Nelson. \$2.00

Birds and Their Attributes. By Glover Morrill Allen. \$1.85

The Common Spiders of the United States. By James H. Emerton. \$1.35

Doubleday Anchor Books, in cooperation with
the American Museum of Natural History

The Yosemite. By John Muir. 95¢

Cells: Their Structure and Function. By E. H. Mercer. 95¢

The Forest People: A Study of the Pygmies of the Congo. By Colin M. Turnbull. \$1.25

Adventures with a Texas Naturalist. By Roy Bedichek. \$1.45

The Navaho. By Clyde Kluckhohn and Dorothea Leighton. \$1.45

THIS GREAT AND WIDE SEA. By R. E. Coker. xv + 325 pp., 32 photos, 23 drawings. Harper Torchbook, Harper & Bros., N. Y., 1962. \$2.25.

One of the few really good books about the sea and how men study it. Its straightforward, balanced treatment of an immensely complicated subject makes it an ideal first book for anyone at all seriously interested in the oceans and marine life.

HANDBOOK OF SNAKES OF THE UNITED STATES AND CANADA. By Albert H. Wright and Anna A. Wright. Vol. III. Bibliography. Pub. A. H. & A. A. Wright, Ithaca, N. Y., 1962. Photo-offset, paperback. 179 pp. \$3.00.

This final volume of the *Handbook of Snakes* contains some 3,000 selected bibliographic entries on the subject. While it does not pretend to be complete, as pointed out by the authors, if used with their previous "Writers on American Snakes" (*Herpetologica*, 1949, 1st suppl.) and with L. M. Klauber's 3,000-item bibliography on "Rattlesnakes" (U. Calif. Press, 1956), it provides a comprehensive base for an historical approach to North American herpetology. The 13-year delay in publication has not improved its usefulness but it is, nevertheless, the only attempt to consolidate the literature on North American snakes.

The bibliography is presented in three sections: general works (62 pp.), life zones, etc. (5 pp.) and state and province lists (107 pp.). Any worker interested in the herpetology of his own area will find this volume of great help. — H. G. DOWLING.

New Members of the New York Zoological Society

(Between July 1 and August 31, 1962)

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Dr. Dominick J. Principato

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Philip Sheridan

John F. Thompson, Jr.

Contributing

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But It Was Tougher In the Old Days

HARRY OVERBAUGH'S Newsletter to Members* about getting the White Rhinos to the Zoo from Zululand started us thinking. Next to Noah, Hercules, we decided, was the most exciting animal collector. Of his twelve labors, seven were straight animal collecting jobs. They were:

- Capture of the lion of Nemea
- Capture of the hind of Arcadia
- Capture of the boar of Erymanthus
- Capture of the Cretan bull
- Capture of the mares of Diomedes in Thrace
- Seizing the cattle of Geryon
- Fetching up Cerberus from the lower world.

Three others directly concerned animals: the destruction of that many-headed monster, the Hydra of Lerna; shooting the birds of Stymphalus; and, of course, that job in the Augean stables. The remaining two labors were collecting of a different kind: getting the apples of the Hesperides, and taking the girdle of Hippolyte, Queen of the Amazons—perhaps the neatest collecting trick of all time.

It's reassuring to reflect that animal collecting is such a time-honored pursuit. Our rare and threatened-with-extinction White Rhinos (although perhaps not so bizarre as Cerberus, the three-headed dog at the gates of Hades) were well worth collecting by the Zoological Society's most recent expedition—an expedition materially aided by the continuing financial support of Zoological Society Members.

MEMBERSHIP DEPARTMENT
New York Zoological Park
New York 60, N. Y.

* There are still a few Newsletters available. Send us a postcard, if you want one mailed to a friend.



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ANIMAL KINGDOM



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ANIMAL KINGDOM

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New York
Zoological Society

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December 7th, 1962

DEAR MEMBER:

The other day a letter was sent to each member of our Society. It is the first letter of its kind that has ever been sent to our membership.

With this letter there went to you also a brief statement describing the ideas and plans we have for the future. I greatly hope you have read this letter and statement and have given it your thought—if not, that you will do so.

Further, this issue of our magazine contains a description of the work of our Society in wildlife protection and in science, of which many of you may not be fully conscious. This, too, it is hoped, you will read.

We have a wonderful membership—over four thousand men and women paying dues that are more than nominal—sure evidence of real interest.

Now, however, we are at a turning point in our history. Our Development Program represents a goal we must reach in order to fulfill our obligations of service to the public—and to animals.

It will be a superb thing if each and every one of our members joins in and helps. We have an unparalleled opportunity ahead of us.

Faithfully yours,

Fairfield Osborn

President

A Close Look at Polar Bears

By MARTIN SCHEIN & F. M. HART

Pennsylvania State University

IN ORDER to gain some insight into the ecology of the Arctic, the American Institute of Biological Sciences sponsored an expedition to Spitsbergen during the summer of 1962. The expedition was organized by Frederick C. Baldwin, a photographer, who served therefore as both the photographer and the administrator for the group. The authors took advantage of the existing expedition and, with the support of the New York Zoological Society, tagged along to do some preliminary observations on Polar Bears. Our objectives were quite simple: we felt that before any long-range intensive studies of the behavior and ecology of the Polar Bear could be planned, we must first have the preliminary information on which such a long-range study must be based. Specifically, since an intensive study would undoubtedly involve measuring and marking the animals, perhaps even attaching radio transmitters on collars around their necks, we had to know whether we could immobilize the bears, work with them, and then release them unharmed. Even more basic, we had to know where we could find appreciable numbers of bears accessible to observation and capture. Any additional information that could be gleaned concerning feeding habits, locomotor patterns, activity cycles and the



like, would be all to the good and would help us in formulating the long-range study.

Spitsbergen seemed to be an ideal place to study the Polar Bears, since a relatively large population of bears frequents the islands as evidenced by the relative ease with which hunters fill their quotas. Baldwin, who had visited the area in 1960, reported that he had no trouble locating and observing numbers of bears stranded on islands. Apparently, they move south with the ice pack in the winter time, and return to the north with the receding ice during the spring and summer. Thus, a north-south migratory route along the eastern side of the islands seems to be well established. The bear's relationship to the moving edge of the ice pack is coincidental: actually, they are largely confined to the ice pack by their favorite food item, the seals. Since bears are not agile enough to catch seals in the open water, their only hope for a meal is to trap a seal that is resting on the ice. As the ice pack recedes northward in late spring and summer, some bears are stranded on small islands in the area. Although they certainly are capable of swimming many miles at a time, we believe that they normally avoid wide expanses of open water unless there is a land or ice-floe goal in sight. Thus, an

ice pack hastened northward by a strong, warm, southerly wind could quickly leave a sleeping bear stranded unless it happened to be riding north with the ice.

Because of its location along the main migratory route, the King Charles island group seems to be one of the main collection areas for stranded bears during the summer. It is an unfortunate place for them, since the seals, which have generally moved north with the newly opened water, are not available in adequate numbers to feed the abnormally high concentration of bears. Hence, the bears are reduced to scraping along as best they can until released from their prison by advancing ice the following fall. During their summer isolation, they have been observed to feed on the sparse vegetation (lichens and mosses) on the islands, and we may assume that the bodies of less hardy bears form a part of their summer diet. What with the severity of their situation,

For eight hours the expedition "herded" this young Polar Bear in Freeman Sound without maneuvering it into a position on a large ice floe where it could be immobilized. Every few minutes it dived while it was swimming, staying under for 5 or 10 seconds. No other bears dived, nor did they swim so much.

From a Kodachrome by Martin Schein



bears stranded on islands are easy prey to hunters, and so the Norwegian government has established King Charles' Land as a game preserve, off limits to hunters and trappers.

So much for background information. The expedition's goal was obviously King Charles' Land, where we should be able to observe the maximum number of bears while expending the minimum amount of effort. The paucity of available food was to our advantage: we should easily be able to use food as a bait to attract bears for close observation or for temporary immobilization. Baldwin, in 1960, found that the bears were hungry enough to swim to the side of his ship and vie for bits of seal much as South Sea islanders vie for coins tossed overboard by tourists. He also told us that there was an old hut on King's Island, one of the three main islands of King Charles' Land, which we could use as a base for observing bears on land.

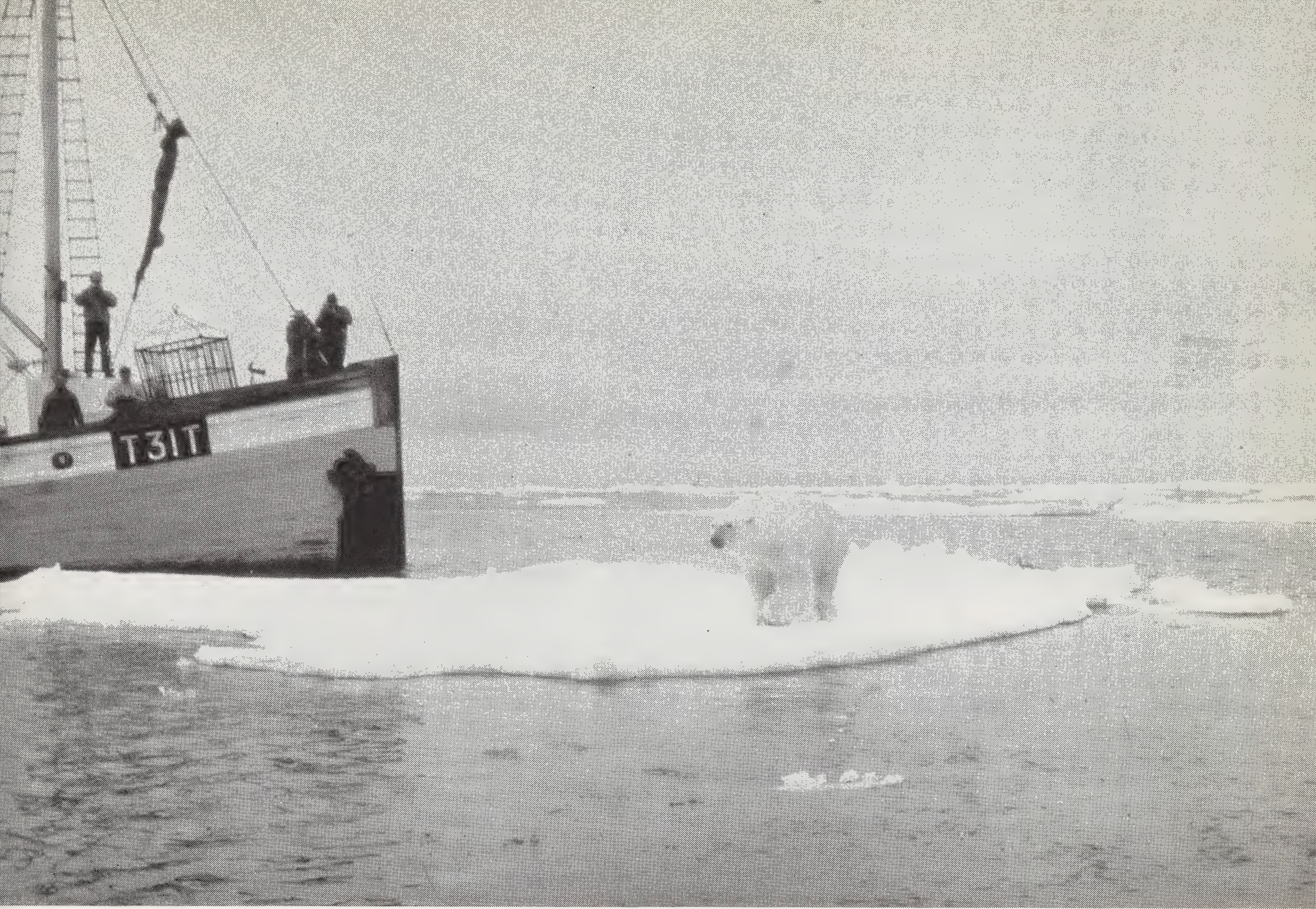
The expedition set sail from Tromsø (northern Norway) in early July aboard a chartered seal-hunting vessel with a Norwegian skipper and crew. Aboard were four Americans: DeCoursey Martin, marine biologist; A. D. Stenger, professional motion picture photographer; Fred Baldwin, professional still photographer and our organizer; and one of us (Hart). Because of previous commitments, the other of us (Schein) could not join the expedition until August. We soon discovered that 1962 was exactly the wrong year for the expedition: ice conditions were more severe this year than has been the case for the past 30 or 40 years; the ice pack simply had not receded, so that the Barents Sea from Hope Island northward seemed to be completely ice-locked. There was little to do but skirt the edge of the ice and hope for a breakthrough in the form of a strong southerly wind persisting for several days. For all we knew and hoped, the ice confronting us might be simply a belt no more than 20 miles wide, with clear water beyond. Therefore, we first tried to flank the ice belt by going through the Hinlopen Strait in the North. This didn't work, and in fact we were caught in the ice for several days and had to wait for tides and winds to open a path for us so we could get out before being seriously trapped.

It was while we were stranded that we sighted our first bear, far off in the distance near the southernmost tip of Northeastland. However,

our immobility in the ice proved too formidable a barrier and the bear disappeared into the distance before we could do a thing. Our second bear was sighted in Lomfjord, off the Hinlopen Straits, and this time we made some attempt to follow it on foot across the ice. The bear was also some distance away and escaped before we could get to it, but at least we got a chance to observe its agility and ease in moving across the treacherous floes. From a distance we watched it stalk, capture and eat a seal, and Stenger tried to document the scene on movie film, using his most powerful telephoto lens.

The expedition returned to Longyearbyen to stock up on supplies and to pick up the other of us (Schein). The northern route to King Charles was impassable, so we decided to try a southern route by way of Storfjord and Freeman Sound. We found Storfjord blocked at first by a band of ice, but some favorable winds opened up a hole and we headed for Freeman Sound. At the entrance to the Sound, just north of Edge Island, we sighted our third bear. We estimated it to be a juvenile, about three years old, and approximately 250 pounds in weight. This time we had the advantage, for there was enough open water around the ice floes to give us maneuverability. Our small 18-foot motor boat was lowered over the side, and between the two boats we could herd the bear as we pleased. The bear started to swim across the Sound towards Barents Island, but we cut it off and kept it away from land and from any large mass of ice. At the end of an hour or two of photographing the bear in the water, we tried to herd it on to a smaller ice floe so as to get photographs of walking and running. However, the bear much preferred the water, and when it did climb on a floe it only ran to the other edge and jumped into the water again.

Its swimming movements were interesting and characteristic: only the front paws are used to paddle, while the hind paws extend rigidly behind and act as a rudder. However, in making a sudden turnabout, the bear rears up by paddling all four legs, and then sets off anew. Of interest was this bear's peculiar habit of diving every few minutes or so while swimming, as if the diving were part of its escape mechanism. The dives were of short duration, and the bear was at the surface again in 5 or 10 seconds. No other bear



that we observed dived in this fashion, but then no other bear was as reluctant to come out of the water. We tried to bait the bear with bits of seal blubber placed on several small floes, but by and large these were at first ignored. After several hours of escape-type behavior, the bear was visibly tired and did take a few chunks of blubber as it loped across the ice. It also paused long enough in its runs to drink fresh water from pools of melted ice on the surface of the floe.

Some four hours after first sighting the bear, we despaired of ever getting it fully on to the ice. Therefore we let it swim to a large pack of loose ice where it could at least rest by standing, still partly submerged, on underwater ledges of ice. We threw seal blubber to it, and observed some feeding behavior. Eight hours after the original sighting, we decided that no major additional information was to be gained from this bear, so it was abandoned and we continued our attempts to get to King Charles' Land, presumably the best study area.

Our way was again blocked by ice at the eastern end of Freeman Sound, so we headed back to

A full-grown adult was discovered in the Disco Bay region and was pursued through water and across ice floes for six hours. It readily climbed on the ice.

From a Kodachrome by Martin Schein

Storfjord and the southern tip of Edge Island. A dual plan was formulated: if possible, we would go for King Charles' Land; if that was blocked, we would try for Hope Island. (Personnel operating the radio transmitters on Hope had informed us that they had captured a young bear the previous fall and it was now getting too big for them to handle; we could have it for our work, if we could get to Hope.) On the way south, the next bear was sighted on the ice along the west coast of Edge Island, in the region of Disco Bay. Again, the waters were open enough to give us running room, and we had no difficulty keeping in close contact with the bear. It was a full grown adult, perhaps 800-900 pounds in weight, and probably five or more years of age. Measurements of tracks in the fresh snow revealed the bear's hind paw to be 17" long (from claw to heel) and 12" wide. Just as with the previous bear, we followed it and took many photos. However, this bear showed no

hesitation about climbing out on the ice, and in fact after the first few minutes of active escape behavior it tended to merely avoid rather than flee from us, and readily ate the chunks of seal blubber we left in several locations.

Six hours later, after we had our fill of photographs, we prepared to immobilize the bear by means of a gun that fires a hypodermic syringe; the object was to observe and time the effects of the drug. The syringe was loaded with succinylcholine, a drug that worked quite well on wild Grizzly Bears in Yellowstone Park and on Polar Bears in several zoos. Although we could safely get within a few yards of the swimming bear in our small boat, we did not want to risk shooting it in the water, since it might sink and drown as the drug took effect. At the same time, we did not feel that we could safely get close enough to it on the ice, for the dependable range of the dart gun was only about 30 yards. We decided to herd the bear in the water towards a large ice floe, and to shoot it just as it emerged from the water; we could get quite close in our small boat and still be safe. The ice floe had to be several acres in extent, so that the drug could take effect before the bear had a chance to get back into the water. The plan worked well: the bear was shot from about ten yards as it emerged from the water, and in exactly three minutes it fell to its knees. Six minutes after injection the hind legs were quite immobile, but there was still some activity in the forelimbs; some yawning and shoulder tremors were evident. After eight minutes it was flat on its belly, head resting but mobile on the immobile forepaws; eyes were open and blinking. One and one-half minutes later head movements also stopped, but the eyes were still open. It lay in this position for about four or five minutes and then began head and weak forelimb movements; apparently the drug was already beginning to wear off. Within ten more minutes it had regained use of the forelimbs and was trying to drag itself away from us. Finally, in another ten minutes (35 minutes after the injection) it staggered to its feet and moved off some 15 yards, only to lie down again for a few minutes. It made several such short moves, each time increasing the distance travelled between rests, and occasionally rolling over in the snow as it lay down. The rolling-over movement caught us by

surprise; it was similar to a dog's movements when scratching its back. Although we had seen this and other bears do it on occasion, we certainly didn't expect to see it now. When the bear got to the far side of the ice floe, a hundred or so yards from us, it settled down for what looked like a comfortable nap. We returned to our ship and spent the next several hours watching it from what we felt the bear would consider a safe distance. Every ten minutes or so it would raise its head and look about, sniff, and then go back to sleep. Occasionally it would get up, move a few yards, and lay down again. These movements we considered part of normal "sleep" patterns, since we had observed undrugged bears doing the same. Four and a half hours after the injection, the bear rose, walked across the ice floe, swam to a larger floe, and disappeared into the distance. We resumed our attempts to get to King Charles' Land.

The ice at the southern tip of Edge Island was impassable, and from various sources we learned that the ice extended southward for quite some distance. Hope Island was completely inaccessible to us. We had no choice but to abandon any plans of getting to King Charles this year, and our only recourse was to scout the edge of the ice pack in hopes of sighting occasional bears. Several days later we sighted our next (and last) bear, off the east coast of West Spitsbergen, near Davis Glacier. This time we planned to immobilize the bear at the outset, so as to observe the drug's effect on an animal that was not exhausted. However, the bear fooled us: she swam to a large ice floe and then pretty much ignored us from the relatively safe distance of a hundred or so yards. She picked up the ragged remains of a small seal and ate while we watched and photographed. (We do not know whether she unexpectedly found the seal remains or whether she knew about its location beforehand). Three-quarters of an hour later she climbed up on a small hillock and lay down to sleep. From her commanding position she frequently surveyed the large ice floe; head up, looking about, sniffing, and then head down again to sleep or rest for ten or so minutes. It is strange that she paid little attention to us as we walked towards her across the ice, despite the fact that we made no attempt to conceal ourselves and the bear was clearly aware of our presence. We approached cau-

tiously to within 50 yards, but it was only when a dart grazed her back that she was disturbed enough to move away from us. We soon got her into a favorable position for a shot, and she fell to her knees 45 seconds after the injection. Four minutes after injection we judged her to be sufficiently unconscious to be tied up so that we could examine her at our leisure. We also decided that as long as we had her completely in our power, we might as well save her for a sunny day: she could be used for underwater swimming photos. Stenger, who is well versed in the art of roping and tying cattle, did a fine job hog-tying the bear.

Approximately an hour after the injection she began to come to and feebly struggled against the ropes. Within another hour and a half we had her on board ship and into a small cage where she quickly became the rather reluctant "pet" of the crew. Three hours after being drugged she was still groggy in the cage, but ate, drank and slept intermittently; in fact, she slept

"Sapphire," as the captured bear was named, became a rather reluctant pet of the crew while she was aboard ship, being used for photography. Here Dr. Schein gives her a daily drink.

From a Kodachrome by F. M. Hart

for most of the next two days. We estimated her to be about three or four years old and perhaps 400 pounds in weight.

Several days later we tried our first series of underwater action photos. Since the bear was housed in the cage that was designed to protect the underwater photographer from swimming bears, some degree of coordinated manipulations were in order. First, we selected an ice-free body of rather calm water as the site of operations: "ice-free" so that the bear could not escape, "calm" to aid in photography. The cage plus bear was lowered over the side of the ship and the bear released into the water, where the small boat was waiting to ride herd from a safe, unexcitable distance. Next, the empty cage was raised, and the photographer in his diving suit got in. The cage (plus photographer) was then lowered, and photos were taken as the small boat kept the bear in the vicinity of the cage. When the photographer was finished, the cage was raised and he was released. Then the cage was lowered again, with the door open. Stenger, who happens to be from Texas, lassoed the bear in the water and it was guided back into the cage. The door was closed, after which the cage plus bear was raised and again settled on the deck. The net results





An iron cage being lowered over the side of the ship. In this cage an underwater photographer could be protected while observing the bear's way of swimming.

From a Kodachrome by Martin Schein

of the whole operation, besides getting our pictures, was to give the bear some much-needed exercise and to give the cage a desperately-needed cleaning. We were able to repeat the procedure one more time before the bear escaped from the cage during a storm. She crawled through the hastily-wired-over top, roamed the deck for a few minutes, and jumped over the side. She was last seen disappearing into the gloom of a nasty snowstorm. The water was too rough to consider giving chase with the small boat, and besides we felt that we had gotten enough information from her. She had earned her freedom.

In summarizing the outcome of our summer's study, we find that we have learned a great deal about the activities and general habitat preferences of Polar Bears in the summertime, and that we can easily tag and intensively study individuals for extended periods of time. The immobilizing drug and dart gun worked well, thus affording us an invaluable tool for the prosecution of further studies. Our knowledge of the locomotor patterns of the bear, both on land and in the water, has been increased considerably. We have gained at least an initial insight into some of the factors affecting the general movements and range of the animal, particularly the relationship between the extent of summer floe ice and the local range of the bears. Also, a limited amount of information was obtained concerning its feed-

ing habits. In addition, we found that we could work and obtain significant information even under the very difficult local ice conditions which considerably restricted our activity.

As a result of our experiences, we now know enough to be able to ask intelligent questions; we now are in a position to design and carry out a study of the behavior and ecology of the Polar Bear in its home environment. Individual animals can be marked and followed with ease; radio transmitters, which can be attached to the animals, would yield much valuable data on their movements, habits and intimate environment. At the same time, a broad international program of information retrieval can be undertaken with the cooperation of interested Norwegian agencies with which contacts have been established. Questions relating to the bears killed each year (numbers, location, age composition, sex, size, etc.) can be answered and such answers may enable us to make estimates of the status and distribution of the population, which in turn can lead to effective conservation practices. (During the winter, a professional hunter may take an unlimited number of bears and kills as high as 100-150 are not unusual). And finally, a detailed study of the ecology of the Polar Bear cannot help but include ecological studies of the seals, reindeer and other arctic species, thereby contributing to our understanding of life and conditions in the Arctic.

Sea Dragons of the Galapagos:

THE MARINE IGUANAS

By HERNDON G. DOWLING

Curator of Reptiles

“IT IS A HIDEOUS-LOOKING CREATURE, of a dirty black colour, stupid, and sluggish in its movements. The usual length of a full-grown one is about a yard, but there are some even four feet long; a large one weighed twenty pounds; on the island of Albemarle they seem to grow to a greater size than elsewhere.”

Thus did the young British naturalist Charles Darwin describe the Marine Iguana of the Galapagos Archipelago in his *Journal* of October, 1835.

A major object of the New York Zoological Society's recent expedition to the Galapagos was to study the temperature relations, general habits and life history of this unusual lizard (see *Animal Kingdom*, Sept.-Oct., 1962). Known scientifically as *Amblyrhynchus cristatus*, the Marine Iguana has no known close relatives and little has been learned about its habits since Darwin made his observations.

Fortunately Darwin was a good observer and in the thirty-five days that he spent in the archipelago he was able to record a great deal of interest about these animals. He noted that all of the Marine Iguanas were found within ten yards of the sea shore, that they entered the sea voluntarily to feed, that they swam with the tail rather than the limbs, that their main food was a kind of seaweed, that they could be held under water for an hour without drowning, that they (unlike the Land Iguanas) do not offer to bite, that they could not be driven into the sea, and that if one were thrown in “it invariably returned in a direct line to the spot where I stood.” Of all the interesting observations that Darwin recorded, only the last has apparently caught the imagination of subse-

quent visitors. I suspect that literally hundreds of iguanas have been thrown into the sea to see if they would return directly to the land. (They did — usually).

Other than this, however, few of Darwin's observations have been rechecked and except for some recent observations on their social behavior during the breeding season by the German biologist Irenaus Eibl-Eibesfeldt, little has been added to the knowledge of their life and habits.

We became acquainted with Marine Iguanas at our first stop in the Galapagos, Wreck Bay on San Cristobal, and were able to observe their activities on each of the other nine islands that we visited. Unlike most of the other native animals of the archipelago, the Marine Iguanas, due to their peculiar feeding habits, do not compete with the goats, donkeys and cattle, or even with man, for their food. With their ranges restricted to the rocky shores, they are not exposed to the packs of dogs on Isabela, and even the pigs of Santa Cruz apparently have not found their eggs sufficiently enticing to make a regular hunting ground of the beaches where the eggs are laid. Unlike the Land Iguana, they are not considered to be good eating by the local inhabitants. Thus, fortunately for the herpetologist interested in them, their numbers are still large and they do not appear to be in any imminent danger of extinction. Man, though, remains a residual danger. Should some enterprising designer suddenly decide that marine iguana skin is just the thing for milady's shoes and handbag some year, they could be cleared from their rocky retreats in a short time.

They have already almost disappeared from the vicinities of long-settled areas such as Wreck Bay



on San Cristobal, where we saw *one*, and Black Beach on Floreana, where a previous expedition reported *nine*. This is exceptional, however, and Marine Iguanas still occur in vast numbers over the islands, islets and rocks of the archipelago.

Besides the addition to scientific knowledge that we hoped to contribute from our observations, there was also a practical zoo-curating reason to be interested. Up until this time no one had been able to maintain these curious animals in a zoological park. As the only lizard in the world that depended entirely on the sea for its subsistence, it was of more than ordinary interest. The Green Iguana of South America, the Rhinoceros Iguana of the West Indies, and even the Land Iguana of the Galapagos could be maintained without great difficulty but the Marine Iguana has always been a different story. As soon as it is removed from its native home, it steadfastly refused to open its mouth to try any of the tempting repasts set before it. Even its favorite seaweed was refused and nowhere was anyone able to maintain a Marine Iguana longer than the time it took it to starve.

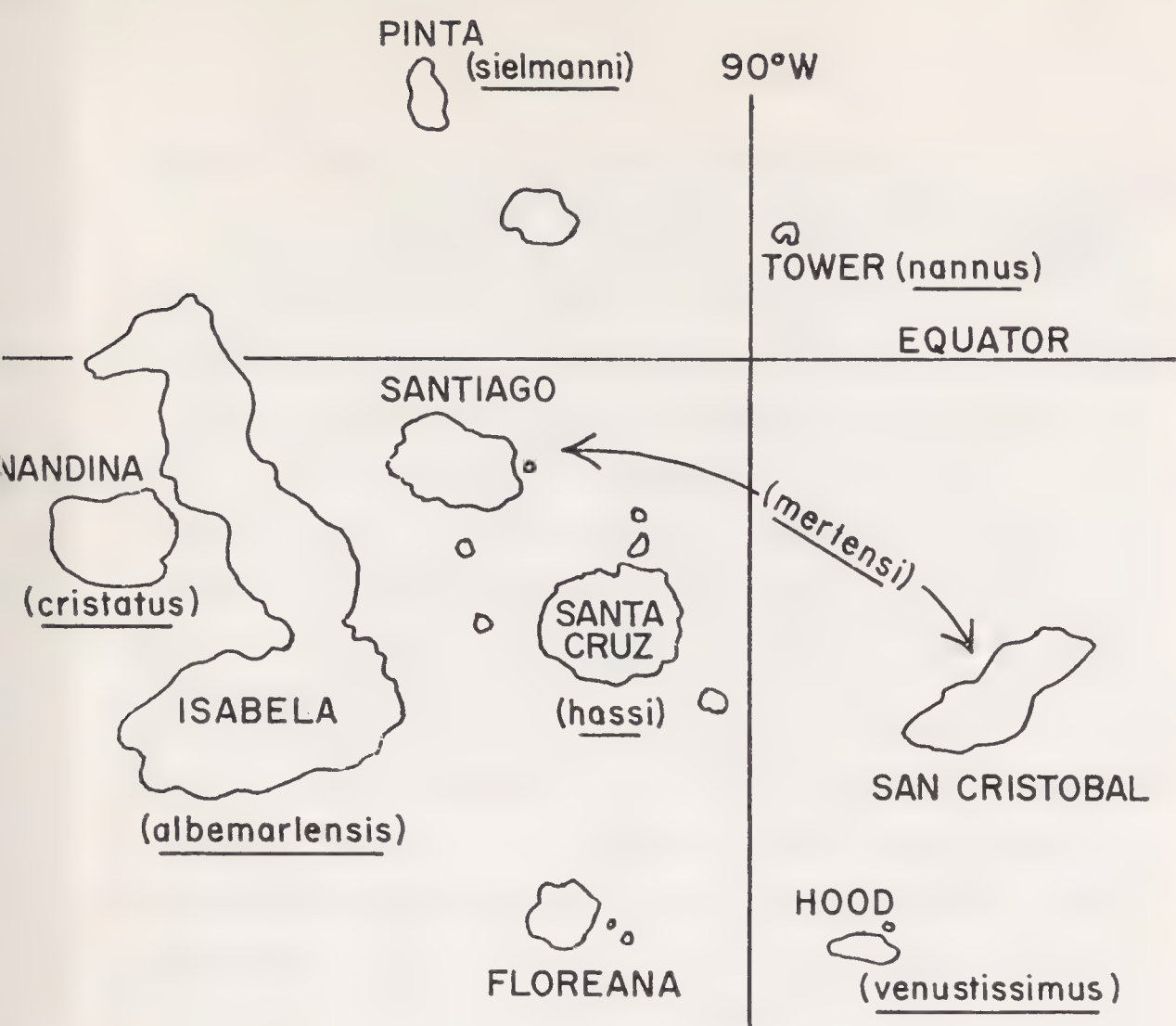
Such a history is very discouraging to reptile curators, and yet photographs have been published of a Galapagos islander feeding these same lizards on scraps of bread and meat from his dining table. Their absolute disinterest in food in reptile houses and the obvious acceptance of new

and strange foods in the islands suggested that it was some factor in the environment of the reptile houses *other than the food* that was causing the trouble.

Remembering the many photographs of these lizards basking on the black lava and visualizing the high temperatures generated by the equatorial sun under such conditions, I suspected that the basic problem might be concerned with temperature. Some lizards, such as the common race-runners (*Cnemidophorus*) of North America normally operate at temperatures well over 100 degrees (F.). Few reptile houses are constructed to provide such temperatures and it seemed reasonable to investigate this aspect of their environment.

With this in mind, I carried a set of sensitive thermister-thermometers to the islands with me. With these instruments it is possible to measure the temperatures of the air, water, ground and the animal all in the same minute. At least that is the theory. When it came to actual practice I found that a person would need about seven hands to accomplish it — including at least two to hold the lizard.

At three of our landing places, on Santa Cruz, Fernandina and Hood, we were actually able to live with the lizards. Nowhere did we live closer to them, however, than on a little islet in the mouth of Academy Bay on Santa Cruz, named



Above—There are seven forms of the Marine Iguana and they are found on eight islands in the Galapagos. Left—Hood Island iguanas basking in the sun. They go to shade when temperatures reach 100° F.

From a Kodachrome by the author

Jensen. On this little spit of lava and sand there were an estimated 2,000 Marine Iguanas—and this was before this year's young had begun to appear. We camped on a sand beach, also occupied by a highly vocal herd of sea lions, between two large colonies of Marine Iguanas. The lizards actually walked over our sleeping bags during their daily travels and we were able to obtain complete twenty-four-hour records of their activities and temperatures.

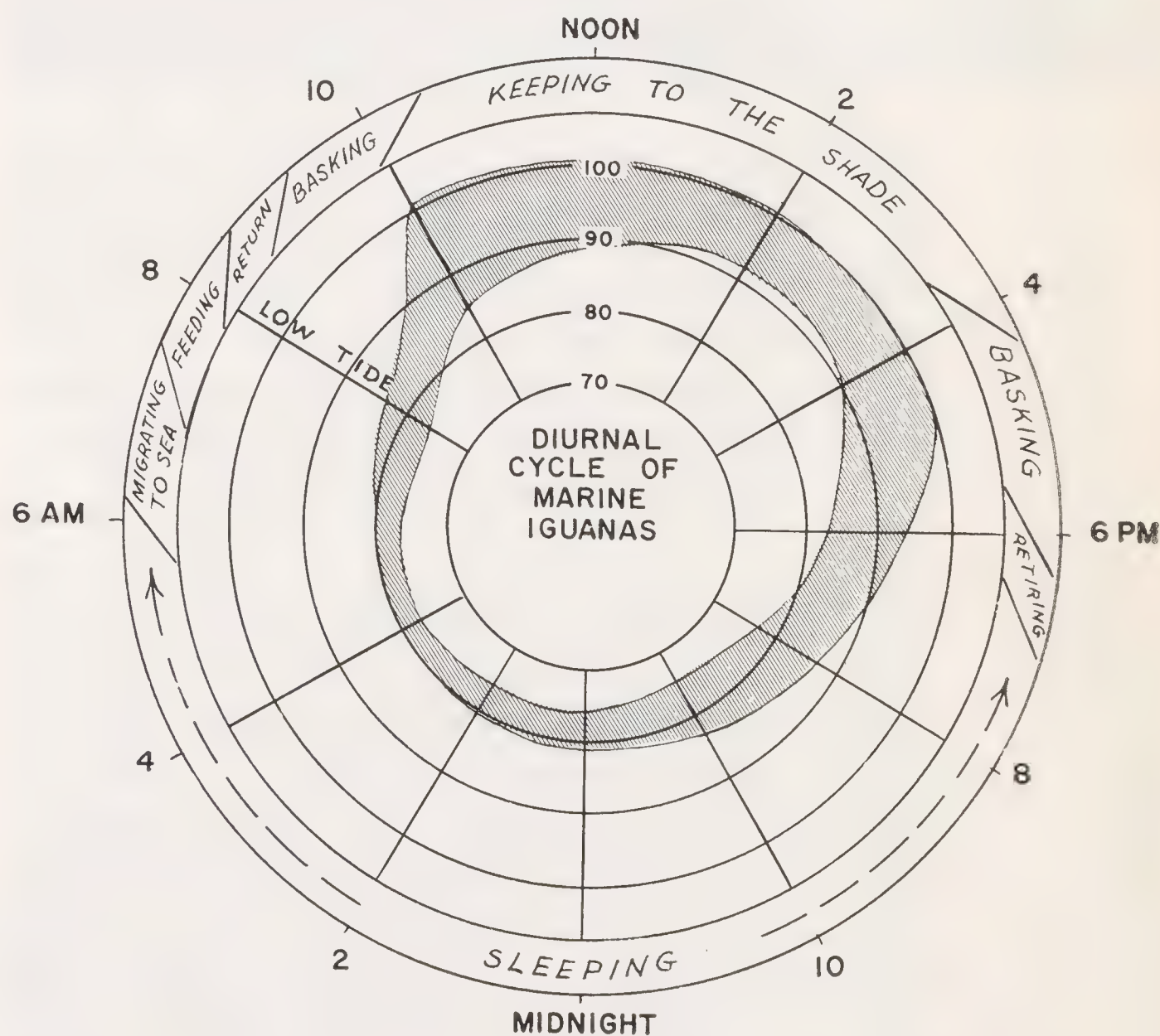
At the time we were there, in April and May, the breeding season was over and the males had changed from the pugnacious and aggressive harem leaders so well described by Eibl-Eibesfeldt to mild and inconspicuous members of the herd. We saw only one pushing contest, when apparently some upstart tried to oust an old-timer from his favorite sunning-spot. Lowering his heavily-tubercled head, the owner dug his sharp claws into the crevices and, although his opponent resisted with an equally buttressed cranium, pushed him neatly off the edge. Other than this flurry of activity, the life of the Marine Iguana during our period of observation was so peaceful that it could only be described as downright lazy.

A typical day would go about like this. Having had a good eleven and a half hours' sleep under a beach-side boulder, the iguana slowly drags itself onto the east side of its sunning rock by 6:15 when the first rays of the sun begin to dissipate

the morning mists. Low tide is early today, so shortly thereafter the lizard makes its way through the boulder rubble at the edge of the beach and swims languidly out to a seaweed-covered rock exposed by the retreating waters.

Now all is activity and the lizard and its companions scramble quickly from rock to rock, turning their pug-noses sideways to crop the already-short sea lettuce down to the edge of the cracks and crevices from which it projects. Like a herd of sheep on a hillside, the lizards graze systematically over the exposed surface and even go beneath the water for some particularly enticing greens. This active feeding continues until the lizard's stomach is filled or until the crashing waves of the returning tide drives it back to shore. Finally, meal time over, the black iguana returns to its sunning rock and begins to soak up the heat of the sun.

As the lizard flattens out on the rock the equatorial sun rises higher in the sky and the night-time coolness gives way to tropical heat. From its night-time environment of 70 to 75 degrees, the iguana has entered a 73-degree sea, but now, ex-



Generalized daily cycle of Marine Iguanas on bright days in the non-breeding season. Low tide is shown at about 8 a.m. but the sequence of migration-feeding-return-basking may take place at any time during daylight, depending on the tide. Body temperatures from 10 lizards recorded at 2-hr. intervals.



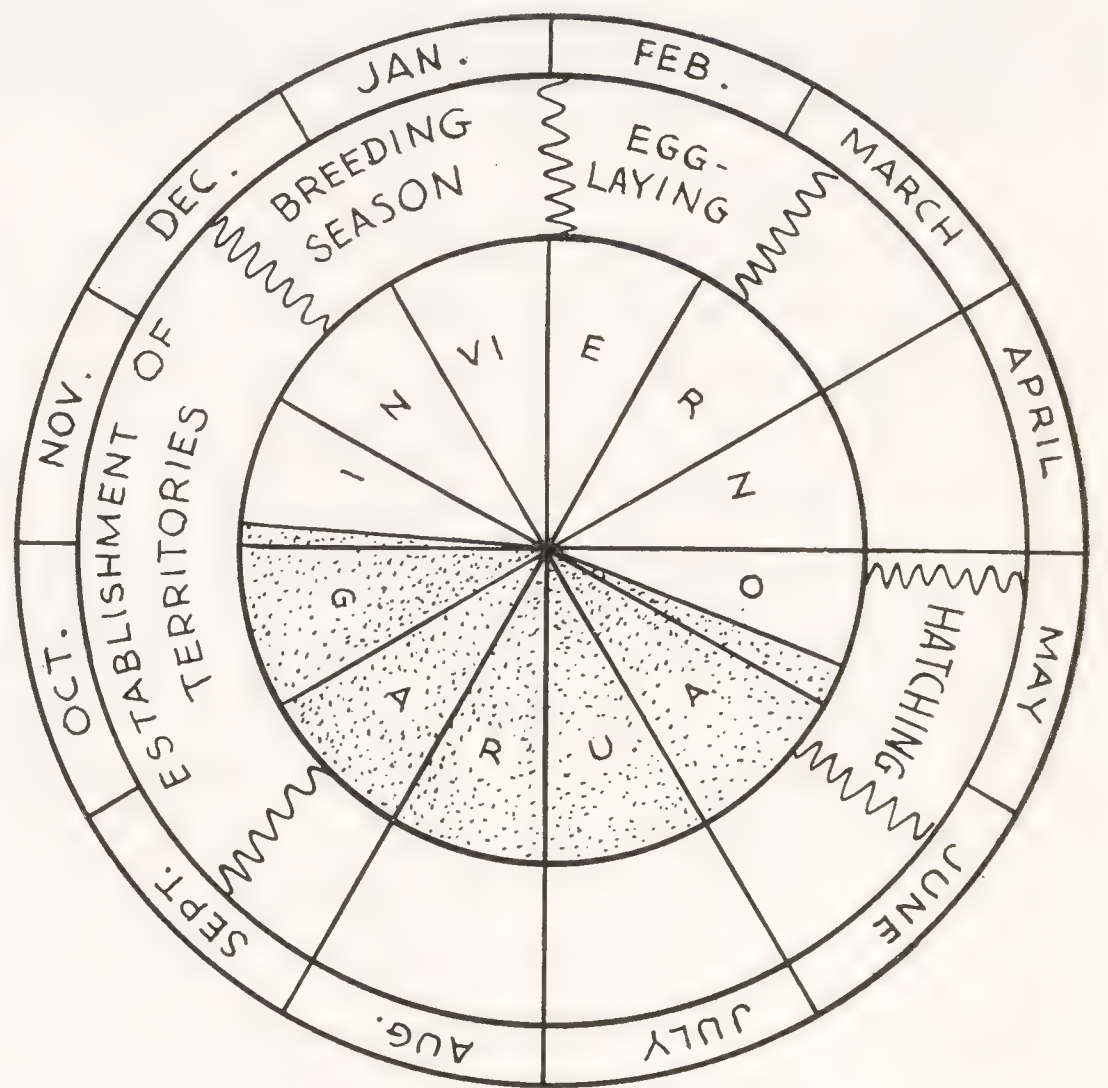
Above — Marine Lizard nests were opened and a record made of egg size. Right — Annual cycle of the Marine Iguana. “Garua” season has cold seas and fog; “invierno” is usually clear and warm. The islands get most of their precipitation in heavy rains January to March.

Egg photograph from a Kodachrome by National Geographic Society (Boyer)

posed to the sun, its temperature approaches the 100-degree mark even more rapidly than the rock. As it heats to this level, the lizard shifts slightly to place most of its body in the shade of an overhanging boulder. By thus adjusting its exposure to the sun and to the heat of the sun-baked rocks, the iguana maintains its body temperature in the 95-to-100-degree range until about four in the afternoon, when the lengthening shadows and cooler temperatures again bring it out into full sunlight. Little by little the sunlight loses its strength and as the rocks radiate their heat into the surrounding air the temperatures of the lizards, too, begin to fall toward their night-time level.

With variations, dependent mainly on the time of the diurnal low tide and the amount of sunlight available, this is the way the iguanas spend six months of the year. Nevertheless, regardless of the many reports, beginning with Darwin, of their “stupid and sluggish” behavior, we did not find them so. Darwin was in the Galapagos during the foggy “garua” season and may never have seen a Marine Iguana warmed up to its normal activity range. The sea is cold during that time as well. This may be the cause of the much-quoted direct return to land.

In fact, one of the characteristics of these sea-going lizards is the alert way that they watch the activities of intruding human beings and although most iguanas will allow a man to approach to within a few feet before moving, this is due



more to inexperience with mankind than to stupidity.

While their daily habits were easy to study on Jensen Island, we learned more about these interesting animals at every station. On Hood, the southeasternmost island of the archipelago, the Marine Iguanas differ from their drab-colored relatives elsewhere in the islands and have their sides splotched with patches of bright red. During the breeding season the Hood iguanas are even more brilliant when the usually dark back takes on a bright malachite green.

We knew that we had missed the February breeding season but upon our first trip to this island in April we were surprised to discover some iguanas still in breeding color. Closer ob-

servation showed them to be females that were staying in and near a nesting area and competing strongly for places in the scanty, rock-strewn soil to dig their nests. Some ten or fifteen were found in this restricted area. Elsewhere their fellows were pursuing their stable and routine out-of-breeding-season lives, but here these females were carrying on their competitive pushing matches in defense of their nest-sites. Could we have come in on the last of the breeding season after all?

Additional observations demonstrated that this was not the case, though they did little to solve the mystery of what was actually occurring. The competing red and green females were gaunt and emaciated as though their struggles had been going on for some time, leaving no time for feeding. When we checked the nest sites that they dug, defended and then left uncovered, we discovered that no eggs were being laid. Examination of the females, themselves, showed that they did not contain eggs ripe for laying. Yet they were carrying the breeding behaviorisms far into the summer season!

We still do not know what was wrong with these lizards, but obviously something had upset their endocrine systems so that their sex hormones were calling forth nesting behavior at a time when there were no eggs ready to be laid. Perhaps an endocrinologist may someday be able to study this queer colony and provide an answer.

Our most exciting experience with Marine Iguanas was on Fernandina. Here on Punta Espinosa, again we were camped right among the members of a large colony. We had been on the island two nights, observing the nocturnal as well as the diurnal habits of the varied animal life, and had already retired on the third night when I heard a scratching sound as some small beast made its way across the equipment pack at my side, and then felt the sleeping bag tug as it started up my chest. Thinking that it was one of the native rats getting a little too friendly, I flung my arm around to knock it off. Instead of the warm furry object that I expected, it was cool and scaly.

My flashlight revealed a tiny Marine Iguana — not a foot long. A sudden grab and I was examining its rounded belly. Sure enough, the navel, where the yoke-sac attaches in the egg, was still open. Our good fortune had exceeded itself; we

had stumbled upon the nesting area during the previously-unknown hatching season!

The following day we discovered other baby iguanas hiding among the roots of the mangroves and under the rocks near the beach. Once Miguel Castro, our boat captain, realized how interested we were, he showed us how to find the nests. It was a matter of ranging along the gray volcanic-sand beach at about the level of spring high tide (the highest level of the lunar cycle). In some of the more level areas were almost invisible shallow depressions, suggested mainly by a slight difference in the texture of the sand. If probing at such an area showed the sand to be somewhat less firm than usual, you might have the nest of a Marine Iguana. Hands only could be used for digging, and with extreme care, for the parchment-like egg membranes were very thin. I dug out a number of such "nests," some of them last year's as shown by the dried shells; many of them not nests at all, as I discovered an arm's length down in the sand.

The actual nests were about a foot from the surface of the coarse volcanic sand, close enough to the sea to remain moist (but not wet) and far enough hidden from the sun's rays to remain a steady 84 to 85 degrees while the sand's surface made its daily cycle from 70 to 130-plus degrees. Each nest contained only two eggs. Dr. Charles Carpenter of the University of Oklahoma, who had observed the lizards during the laying season in February, had noted this also.

When we returned to our base on Santa Cruz, we found that hatching was occurring there too. We found the holes in the beaches from which the hatchlings had emerged and the tiny iguanas hiding in the dense brush behind the beaches. Miguel Castro, after a trip to Tortuga Bay, told of seeing the young emerge from the sand on that foggy day, and of the Lava Gulls swooping down to catch them before they could get to the cover of the bushes. Probably the baby lizards ordinarily emerge at night, as on Fernandina, when there are no avian predators on watch.

With only a single laying season and thus with only two eggs produced by a female lizard in a year, it is understandable how these animals would be so vulnerable to any unusual predation. There is still much to be learned about these breeding habits. We do not know whether all the

adult females lay each year or whether, as in some species, only half that number do: each female laying only on alternate years. Only a great deal of additional work can provide even this basic information about their chances of survival.

Nevertheless, we have learned quite a bit. When we went to the Galapagos I did not know but that perhaps the Marine Iguanas were active at night. Copperheads (*Agkistrodon contortrix*) of our own country, which sun during the day, are certainly nocturnal. As it turned out, though, practically all of the reptiles of this isolated archipelago are diurnal, day-active, species. Without any of the usual dangers of mainland life, they could afford to be before man and his associates invaded the islands. Only the geckos, caught by their nocturnal-structured inheritance and perhaps more susceptible to bird predation because of their size, have a night-active existence among the reptiles of the archipelago.

We had heard about "tame" Marine Iguanas before we came to Santa Cruz but the actual viewing of the spectacle was even more impressive than the reports. Soon after we first arrived, I went across Academy Bay to meet the "iguana tamer," Carl Angermeyer, and asked about his iguanas. His house is built at the edge of the sea on a rocky point and, as he explained it, he merely moved onto the cliff with his friends the iguanas, disturbing them as little as possible.

Gradually they became accustomed to his house and began to accept the scraps of food that he offered them. "They like meat especially," he said, "Let me see what we have." Returning from the kitchen he said, "All we have is some salami; that will have to do."

With this he cut off a small strip of salami and threw it on the floor of the patio near a Marine Iguana that was sunning itself. Becoming alert immediately, the lizard crawled over to the strip of meat, sniffed it, and then gobbled it down, licking its chops with obvious satisfaction. Several other heads were lifted from the cliffside rocks now and when Carl threw another strip, two other iguanas scurried over to share in the meal. By the time a few more pieces had hit the floor, six to eight iguanas were scrambling for them like hungry chickens after corn.

Carl said that his wife ordinarily made up a pot of oatmeal or something like that for the

iguanas every day. Besides eating this food, they went down on the rocks at low tide and grazed their accustomed sea lettuce. It became obvious on my subsequent visits, though, that the Marine Iguanas would eat anything that Carl offered them. Sometimes I found two or three iguanas sharing a dish with the Angermeyer's cat or dog, both of which had been trained to tolerate, if not to enjoy, the presence of the iguanas. One day I discovered six iguanas with their heads in a cooking pot, eating as fast as they could, each apparently trying to outdo the other. When I investigated the contents of the pot it was — mashed potatoes. And these are the most difficult lizards in the world to keep in captivity!

During our studies of the Marine Iguanas it became clear that the problems of maintaining them were not only physical, but psychological as well. Their alert stance, their observation of movement at great distances, the rapid learning shown by the new lizards that joined Carl Angermeyer's "friends," all indicated that considerable effect is exerted on these animals by the changing conditions of their surroundings. It also became evident that while their temperatures were high, they were by no means extreme.

Thus, I felt that to keep them in a zoological park involved more than the mere provision of proper heating, food and such easily accommodated features; we must be equally concerned with training the animals to adjust to the changes in their environment — such as eating from a dish rather than grazing from a rock, listening to the babble of people rather than the roar of the sea, and most of all perhaps, restricting movement to a small area.

To do these things gradually, so as not to throw the animal into some sort of psychological state of shock, was not easy. Nevertheless, by "borrowing" a couple of Carl Angermeyer's iguanas, we were able to educate a few individuals to the complex behavior of eating oatmeal and crabmeat from a bowl. As so often happens, the young lizards adjusted better than the old ones.

We still have three such individuals, one of them a hatchling from Punta Espinosa. If the canned dogfood, lettuce and chopped fish that makes up their present diet fulfills their dietary needs as well as it appears to, we will have them for a long time to come.

Does the Shrimpfish Swim Head Up or Head Down?

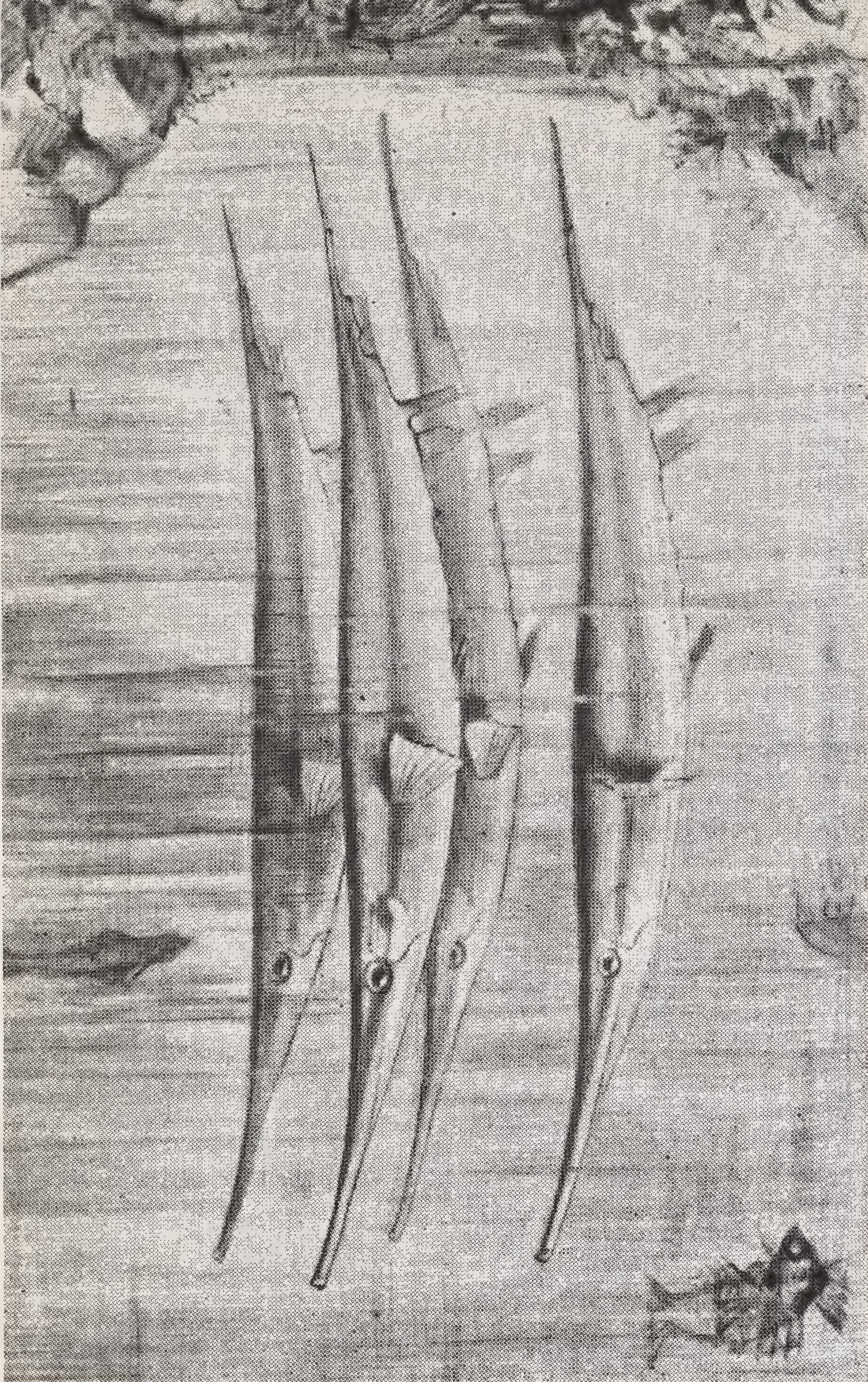
By JAMES W. ATZ
Curator, New York Aquarium

THE LOCOMOTION OF FISHES has always fascinated naturalists, and with the ever increasing importance of man's underwater activities, the scientific study of how fish move about has taken a decided practical turn. After millions of years of evolution in lakes, rivers and seas, fish can move through water with an efficiency that baffles our best engineers. The acme of piscine locomotion might seem to be a tuna or spearfish streaking through the water, but speed is not the only measure of proficiency. For example, the slow-moving but precisely oriented seahorse is, in its way, as efficient — and awe-inspiring — as the fastest fish. Moreover, although the hydrodynamics of its methods of propulsion may not teach us how to streamline torpedoes or design record-breaking submarines, there is much to be learned from a systematic study of seahorse locomotion. We found this out in the old Aquarium down at the Battery in New York when Director Charles M. Breder, Jr., analyzed the movements of the common seahorse with the help of Dr. Harold E. Edgerton, pioneer in ultra-highspeed photography. With the aid of a motion picture camera that took 300 photographs each second and a still camera that snapped photographs in one ten-thousandth of a second, Drs. Breder and Edgerton found, among other things, that the rays of the dorsal fin of the seahorse beat back and forth 35 times per second — a speed that compares favorably with that of a hovering hummingbird's wings.

The Aquarium recently exhibited its first shrimpfish, whose locomotion closely resembles that of the seahorse, even though the fish itself is strikingly different in appearance. Not having a stroboscopic motion picture camera at our beck

and call, we could obtain only a general idea of how this fish propels itself, but we were able, at least to our own satisfaction, to settle a long-standing question concerning its swimming behavior, namely: Does the shrimpfish swim head up or head down? Offhand, this would seem to be a question that could be answered about any fish by a mere glance. The fact that the shrimpfish has been observed off and on by scientists for more than 60 years and still they cannot agree which way the fish's head points when it swims either speaks poorly for the capabilities of ichthyologists or indicates something very strange about shrimpfish.

About the strangeness of the shrimpfish there can be no doubt, and this includes its swimming behavior, so the ichthyologists have an "out" if they need one. About the worst they can be accused of is poor communication. Perhaps if they had paid more attention to one another's reports, the whole matter would have been settled by now. On the other hand, perhaps Arthur Willey's observations became too well known. At the turn of the century, Dr. Willey was collecting and observing marine life in the south Pacific when he made the acquaintance of the shrimpfish. He described this in his journal, which was published in 1902: "This species lives in small shoals of about half-a-dozen individuals and swims about with rapidity in a vertical position, cleaving the water with its razor-shaped body. I was greatly astonished when I saw these spectral fishes flitting about and I pursued them with much perseverance in my dinghy, but although I came up with them several times they doubled back with such deftness that they completely baffled my attempts to catch them with a pole-net." Subse-



quently Willey was able to obtain specimens and identify them. He wrote nothing more about the locomotion of the shrimpfish, but accompanying his text is an illustration that shows a group of four swimming vertically with the head up. The artist, a Mr. Edwin Wilson, must have made the drawing under Willey's direction, and we have no choice but to assume that this is the way the fish looked in nature to the Cambridge zoologist.

Illustrations based on this drawing have appeared in several of the leading ichthyological texts of our times, including Weber and de Beaufort's *Indo-Australian Fishes*, J. R. Norman's *A History of Fishes*, and the latest edition of the *Traité de Zoologie*. Several ichthyologists and collectors, however, have reported that although the shrimpfish does indeed swim with its body held in a vertical position, it swims with its head

down, not up. The number of men who have done so is impressive, and in each instance the authors themselves actually saw the fish under natural conditions or in aquaria:

Gustave Schneider, 1897

F. W. Townsend, 1905

A. W. Herre, 1934

Delsman & Hardenberg, 1934

Georg Duncker, 1937

H. W. Fowler, 1956

E. S. Herald, 1961.

The observations of Albert W. Herre, an American biologist who spent many years studying fishes in the Philippines and southwest Asia, are typical: "Large numbers of living specimens were observed. I have watched them drifting in and out with the tide, floating with a current, in tide pools, and have kept them in aquaria, yet have never seen them in any position except vertical, *with the head down*." When all these personal accounts are stacked against Willey's and those of I. S. R. Munro and J. L. B. Smith, who agree with Willey but give no details about their reason for doing so, the weight of the evidence appears to be definitely in favor of the head-down position. Moreover, a striking photograph, taken

This drawing of four Shrimpfish swimming head up was published in 1902. Since then most observers had indicated that the fish swims only with its head down. The truth is it actually can do both

not long ago in one of the tanks of the aquarium at Nouméa, shows a group of 18 shrimpfish all with their heads down.

Anatomically, the head-down position also seems more plausible. Shrimpfish are long, slender and very thin, with a belly that appears knife-sharp and a back that is scarcely wider. (Our two specimens, which were about three and one-half inches long, measured not quite an eighth of an inch across the eyes, their widest point). This characteristic is responsible for one of their popular names: razor fish. The name shrimpfish arises from the light armor plates that cover most of the body. These do not make the fish look like a shrimp while in the water, but when held in the hand, the impression is strong that one is handling a crustacean and not a fish. The fish's cuirass, as it is technically known,

seems to have just about the same degree of flexibility and toughness as the exoskeleton of a market shrimp. Although the body of the shrimpfish is slightly flexible, the fish is immobile except for its fins, mouth, gill-covers and eyes — the latter being reported as capable of movement independent of each other, like those of the seahorse. The shrimpfish is, in fact, distantly related to the seahorses. One of the strongest indications of this affinity is its tiny, toothless mouth located at the end of a snout so long that it accounts for nearly a quarter of the fish's total length. Like the seahorse, the shrimpfish has to depend on the rapid motions of its small fins to get about, since it cannot flex its tail and the rear part of its body from side to side in order to drive it forward through the water, as conventionally constructed fishes do. The unique arrangement of its fins, more than any other feature, indicates that the fish's head must point down when it swims in a vertical position.

Although the two sets of paired fins of the shrimpfish are located where they are in practically all fishes (that is, the pectoral fins behind the gill-covers and the ventral fins on the belly), the location of the single, unpaired fins can only be called weird. In effect, the two dorsal fins have been pushed off the fish's back into the spot where the caudal or tail fin ought to be, and the displaced caudal fin has taken a position at the rear of the fish's belly. To accomplish this, the posterior quarter of the spinal column bends downward at about a 30-degree angle so that although the caudal fin retains its normal attachment to the end of the spine, it looks, at first glance, like the anal or belly fin, which fin actually lies immediately in front of it. The shrimpfish thus has three small, unpaired fins attached to the lower rear part of its body; reading from front to rear, they are the anal fin, the caudal fin and the second dorsal fin. (The first dorsal fin is stiff and immobile). These fins are located most advantageously to move a vertically oriented shrimpfish in a horizontal direction when the fish's head points down, not up. As the German ichthyologist, Georg Duncker, pointed out, the fish moves with its back first.

When a shrimpfish is hatched from its egg, its backbone is straight and all its fins in the ordinary position, but by the time the baby fish has reached

a length of one inch, its spine has started to bend downward and its fins to take up their strange final locations. At the same time, the fish begins to assume a vertical stance in the water.

Despite the anatomical and behavioral evidence, the matter is not to be settled without further considerations. Under most conditions, shrimpfish undoubtedly swim head down, but do they *always* do so? Statements by zoologists with as much field experience as Willey, Munro and Smith cannot be discounted without very good reason. Nor can those of Max Weber and Robert Rofen, who have reported that they have seen shrimpfish swimming in a normal fashion — that is, with the body held horizontally. Even Dr. Herre, who declared that he had watched shrimpfish for hours, day after day, on the reefs of the Sulu Archipelago and had never seen them assume any position other than the vertical, head-down one, admitted that experienced Philippine fishermen told him they had seen the fish swimming head up a few times.

Willey was not the only one who found the shrimpfish so agile it was very hard to catch. Drs. Fowler and Smith have also commented on the difficulty they had in capturing the fish. Undoubtedly this is one reason why the Aquarium had to wait until this year to obtain its first examples. Although shrimpfish occur in warm, shallow, marine waters all the way from the Red Sea and east coast of Africa to China and northern Australia, they do not appear to be common anywhere. On the other hand, they do not seem to be excessively rare either. Our two fish came to us quite prosaically from a local pet trade show — for which commercial fish dealers often import a tankful of unusual and colorful marine fishes in order to attract customers to their booths. Director Christopher W. Coates spotted the shrimpfish, along with some other rarities, and purchased the lot, to be delivered to the Aquarium at the conclusion of the show.

The opportunity to see a live shrimpfish was something for which I had been waiting 25 years. But for all my anticipation, I was unprepared for the fish's tremendous mobility. Of course, the first thing I noted was that the fish maintained a vertical, head-down position and that their backs cleaved the water as they moved horizontally. This was just as expected. But when they were

disturbed, the fish displayed a surprising ability to make rapid changes in direction, turning about their long axes so quickly and precisely that they reminded me of soldiers on the parade ground executing *Right face* or *By the right flank, march*, or their mirror-image counterparts as the case might be. The two fish also moved straight up and down with the greatest ease and occasionally performed a sort of vibratory dance, looking as if they were suspended on rubber bands. It was not until Staff Photographer Sam Dunton and I placed one of the fish in a tank to photograph it, however, that I fully realized how amazingly



varied the movements of a shrimpfish could be. The water in the small aquarium was only five inches deep, and the fish evidently requires a certain minimum depth in order to take a vertical position, because as long as it remained in this confined space, it never oriented itself vertically, which was the position we wanted to photograph. When we gently tried to maneuver it into the desired position, it swam horizontally backward and forward and at all angles except the vertical. It rotated about, swimming on its back, side or belly with equal facility. In fact, it assumed just about every possible position except the vertical head-up or head-down ones. As soon as we returned it to the much larger exhibition tank, it once more took up its usual vertical stance.

While watching our shrimpfish, I noticed that they frequently rested just beneath the surface of the water with the movable tip of the spine of the first dorsal fin, which projects straight out behind the body, bent more or less horizontally, apparently deflected by the high surface tension of the liquid. Of the three species of shrimpfish generally recognized by the experts in fish classification, only *Centriscus strigatus* has such a jointed, movable spine. Since this appendage is not only attached by a fine joint, but is equipped with muscles and tendons and nerves, I assume that it can be moved and could also act as a sensory device to inform the fish when it was at the surface. This might prevent the fish from exposing itself to attacks by birds and other above-water predators during its rapid up and down movements. Several times I saw one shrimpfish move upward while in the vertical position, until the end of its movable spine became bent. The fish then quickly stopped, leveled its body, and swam off horizontally, just under the surface. I also noted that our shrimpfish sometimes fed on extraordinarily small bits of food — items so small

The typical Shrimpfish stance is head down. Starting from the bottom, the fins on its belly are the small, paired ventrals, the anal fin, the caudal fin and the second dorsal fins.

In a photographic tank, the Shrimpfish swam on its back, as shown here, and many other ways. The jointed spine of its first dorsal fin and its tiny mouth are also apparent.

that the seahorses, which shared their tank and were of about the same length, ignored them completely.

I never did see either of our shrimpfish swim with its head up. Nevertheless, what I observed of them, in both the photographic and exhibition tank, convinced me that they were capable of doing so. Each pectoral fin moved, as a unit, alternately back and forth and at the same time vibrated so rapidly that its edge was practically invisible. The three fins at the rear part of the body also vibrated; occasionally trains of waves could be seen passing up or down them. It will



require the help of a slow-motion camera to find out what these fins are actually doing. Their actions must be complex, for the shrimpfish is able to move in almost every direction by beating them in different ways and combinations. The seahorse uses its fins in a similar way, but no seahorse can stand on its head, spin like a top or perform many of the other feats that are part of any shrimpfish's routine repertoire. Someday we want to study the locomotion of the shrimpfish, just as Dr. Breder did with the seahorse twenty years ago.

In the meantime, we believe that we have the answer to the heads-up, heads-down question. Although shrimpfish seldom swim with the body held vertically and the head up, they certainly are capable of doing so. Dr. Robert Rofen recently made an observation that we believe clinches the matter. While under water, he watched some shrimpfish that were swimming head-down along the bottom of a small, submerged cave. When the fish came to the vertical side of the cave, they simply continued to swim along the surface, snout down; that is, they swam upward with their bodies horizontal but still oriented vertically with relation to the surface of the cave. When the fish reached the roof of the cave, they continued to explore the surface with their snouts. Now their bodies were vertical and their heads were pointing up. For these fish, gravity is apparently not the all-important orienting force that it is to the vast majority of terrestrial animals. Illumination and solid surfaces may be equally important to them. These factors could be experimentally controlled, and such experiments might tell us under what environmental conditions a shrimpfish will swim head up or head down.

Arthur Willey was evidently not "seeing things" after all. Shrimpfish can and do swim with the body held in a vertical position and the head up. But that famous illustration of his raises still another question! Its caption declares that the fish in it are swimming from right to left, that is, belly first. Yet everything we have read or observed indicates that shrimpfish in the vertical, head-up position would swim with the back first, the belly trailing. We are not even going to try to answer this question until we get a chance to study some more live shrimpfish.

THE FRIENDLY LITTLE BANANAQUIT

By OLIVER GRISWOLD

*Coordinator of Radio, Television and
Film Dept., University of Miami*

OF ALL the birds I have put aboard the airliners in Miami for the Bronx Zoo, the ones I worried least about were the bananaquits. They look delicate but they have a strong streak of adaptability to strange surroundings and situations — even airplanes. I know, because many bananaquits and I have been personal friends.

These gay, yellow-gray-and-black bits of action are members of the honeycreeper family, and under the name *Coereba flaveola* ornithologists recognize no less than thirty races or subspecies. Their range is generous, too, all the way from Central America well down into South America. In the Caribbean they go under 17 different local names. Their quick-flitting flight and acrobatics among the flowering shrubs are well known in the Bahamas, the Lesser Antilles and all the Greater Antilles except Cuba.

Even travellers with a minimum of interest in birds bring back anecdotes of the antics of the “sugarbirds,” for this is not a species that has to be sought out with patience and persistence. It seeks out people, and “sugarbird” is one of the most apt of its many names.

Incidentally, although it is not often seen in Florida, it does occur often enough not only to



The Bananaquit is a nimble acrobat as it moves among flowers, clinging to the side of a stem or even hanging upside down. Tropical flowers are likely to contain numbers of tiny insects.

From a Kodachrome by the author

be included on the state's list of specialties but also to be considered the only North American honeycreeper, even though only an “accidental.” It probably flits over from the Bahamas.

I first met bananaquits in Nassau. They were working through hibiscus foliage, probing the blossoms for nectar and insects, and they impressed me with their self-confident and business-like approach to feeding. And here, too, I heard the first tales of their “friendliness.” A pair of bananaquits had apparently adopted a certain restaurant-bar, where they stole sugar from the tables in the patio — often while the diners were still at the tables. Sometimes they hung around until the tables were empty and then had a wonderful time feeding on the wet, undissolved sugar in the bottoms of cups.

When it came nesting time, as it does several times a year for these compatible couples, this pair found an ideal site — an ornate chandelier in the barroom. No cats could get at them, the garden was full of nectar-bearing flowers and the

tables of sugared cups. And they had a friend and protector in the bartender, for no other bar in town had a bird's nest in its chandelier. The bar's business was said to have improved remarkably, and the birds certainly thrived; it was, I thought, a rather unusual example of symbiosis.

You hear lots of stories about how bananaquits' appetite for easy sweets overpowers timidity. In Tobago they have been known to flit into bars and drink the last drops from liqueur glasses. The fastest purloining I have personally witnessed was in the faculty club of the University of Puerto Rico. Professors lunching in the open dining room often failed to replace the lids of the sugar bowls, and bananaquits lurked in the shrubs outside, ready to race the waiters for the sugar as soon as the guests rose to depart. If the waiters got there first, well, there were usually a few spilled grains of sugar on the cloth.

On many of the Caribbean islands the globular nests of bananaquits are built in the shelter of hotel verandahs. The guests find the birds amusing subjects of conversation and the hotel personnel and their feathered residents develop a mutual tolerance.

I have a theory — although I would not push it vehemently — that because of hotter sun and more frequent rain, more tropical birds build globular nests than the northern species. However that may be, bananaquits construct a well-made, roundish bundle of fibers with a side entrance, usually with a "porch roof." Often it is hung conspicuously on the end of a limber branch, where it bobs freely in the breeze. Two kinds of nests are built, both exteriorly of rough grasses and fine stems. One is for sleeping, the other for rearing the young, and the latter is lined with softer fibers.

I remember one bananaquit nest in Puerto Rico that was attached to the tip of a thin branch overhanging a highway. Every truck that roared past barely cleared the nest, and behind it the bough was sucked down until it seemed certain to break. But it always whipped up. I wondered that the eggs could survive such violent tossing.

They obviously did, for the mother paid regular visits to the nest with food between passing vehicles.

As the bananaquit flicks among the shrubbery, one's main impression is of a little black and yel-

low bird with a long and strongly down-curved bill.

Normally it feeds for the most part on nectar and the soft-bodied insects that lurk in the depths of flowers. Pluck a hibiscus blossom and shake it vigorously over a sheet of white paper, and you may be surprised at the number of tiny insects that drop out. *You* may be surprised, but a bananaquit wouldn't be, or a hummingbird, either. Blossoms are their ever-stocked larders.

Bananaquits customarily feed by clambering through the foliage of outer tips, making their way from flower to flower. This climbing is an exhibition of nimble, sure-grasp acrobatics. Sometimes upside down, sometimes straddling between twigs, sometimes revolving around a twig like a gymnast, the birds may even swing on extended legs head down like a circus aerialist.

Although they prod their curved bills into the recesses of blossoms as hummingbirds do, and for the same diet, they do not hover in front of flowers. Sometimes they come from behind a flower and bend their necks around the petals to reach inside. If the flower is large enough, they may climb in. If it is slippery, they flutter to support themselves. But this is not true hovering, the kind that hummers perform so well.

Hummingbirds are said to pierce the base of a blossom with their bills if they cannot extract all the nectar through the opening of the flower. I have found many such piercings but have never seen a hummingbird make them. On the other hand, I *have* seen bananaquits puncture the bases of hibiscus and the similar turk's cap.

Their songs vary. The version I like most is the Jamaican bananaquit's buzzing *zwee-zwee-zwee*. It manages to trill and buzz at the same time; the effect is something the ear can remember easily, but which defies the vocabulary.

When I have captured bananaquits for transport to the north, they always give the impression of being quite unworried by what is happening to them. They are always easy to remove from the capturing nets, remain quiet in the hand, and when popped into cages they set about an unhurried exploration and pick out the best perch. Often within minutes they take sips of a nectar-simulating liquid food. And within hours they are indicating their contentment by a carefree buzzing *zwee-zwee-zwee*.

News from the Conservation Foundation

Atlantic Salmon Study

A comprehensive monograph on the present state of Atlantic salmon fisheries has been initiated by the Foundation. Studies will be carried out in various countries where this fish has commercial and/or sports angling importance, such as the Baltic and Scandinavian countries, the British Isles and possibly Finland. The study, to be undertaken by Anthony Netboy of the Division of Humanities, Portland State College, Portland, Oregon, will supplement Dr. Wolf's outstanding study of the Swedish salmon problem. It will not only analyze international agreements but will review the history of the Atlantic Salmon in Europe and North America.

Distribution of the monograph as a Conservation Foundation Study will be made some time late in 1963. Mr. Netboy may be remembered by conservationists as co-author with Bernard Frank of "Water, Land, and People" (Knopf, 1950), reviewed most favorably by Dr. Fairfield Osborn in the *Saturday Review*.

U.S.D.A. Centennial Film Festival

Secretary of Agriculture Orville K. Freeman took time out from a busy schedule to address 200 film producers, editors and distributors in the Jefferson Auditorium in Washington on November 7. He emphasized the need for communication and the urgent necessity for both the television and film industries to keep the public informed of the increasing productivity of agriculture in the United States. He predicted that by 1980, despite a rapidly expanding population, some 80 millions of acres of productive land could safely be put to recreational and other economic uses.

Films winning awards in the conservation class, which the Foundation's representative helped to select, included "Water, Pattern of Life," produced by the Ohio Water Commission, and "Canadian Portrait," sponsored by Crown Zellerbach. A special award was given to the Geological Survey for "The 1959-60 Eruption of

Kilauea." Of special interest was a session devoted exclusively to films produced in Mexico, Costa Rica and Bolivia indicating the growing interest of these Latin-American countries in conservation.

Briefly Noted

Dr. Fairfield Osborn spoke on "Population Growth versus Resources" at a conference on "The Economic Consequences of Population Explosion" co-sponsored by the Planned Parenthood Federation of America and the World Population Emergency Campaign. The meeting was held at the Plaza Hotel on October 22 . . . Paul F. Brandwein is conducting course 455 at the New School for Social Research, "Advanced Study: Life" . . . Edition No. 6 of the Foundation's Newsletter, "101 Experiments in Conservation," has been distributed to a record number of 4,300 teachers throughout the United States and Canada . . . Dr. Frank Darling and Noel Eichhorn are presently completing their initial field studies for the National Park Survey at Chiricahua National Monument, Dos Cabezas, Arizona . . . George Brewer has written an article "In Search of a Conservation Ethic" which will appear in the January issue of the Columbia University Magazine *Teachers College Record* . . . On October 19 Frank Fraser Darling was appointed a member of the National Academy of Sciences Advisory Council to the National Parks Service . . . Samuel H. Ordway and George Brewer attended the annual meeting of the Natural Resources Council of America at Lake Placid, under the direction of Chairman Roger Hale. Mr. Ordway was elected to the Executive Committee . . . Dr. William Vogt leaves for Mexico on his South American reconnaissance study for four weeks beginning December 29. His itinerary calls for two weeks in El Salvador and a possible visit to Costa Rica . . . Martha Munzer and Noel Eichhorn will attend the National Air Pollution Conference in Washington, December 10, 11 and 12 .

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Public's Feeding of Animals In the Zoo Prohibited

Whether the public should be allowed to feed the animals in a zoological park is a matter that has been long debated and variously decided among zoo people in this country and abroad. The trend has been toward a strict enforcement of the "No Feeding" rule and the Bronx Zoo has now joined the movement; strongly worded signs to that effect are being put up at all gates and throughout the Zoo this winter.

Many instances have been noted recently of visitors offering unsuitable food — even what appeared to be the gleaning of garbage cans — to animals. Often the offerings are food which the animals will not eat, and which makes the enclosure unsightly.

The only exceptions to the prohibition are foods — calf pellets and cracked grain — from our food-vending machines, which we know to be clean and suitable for specified animals, and such foods as popcorn and crackerjack, which may be offered to the elephants. It is, after all, hard to upset an elephant's digestion with popcorn.

Dr. Beebe's Bathysphere On Monaco's Stamp

A reproduction of the Bathysphere in which Dr. William Beebe and Otis Barton made their record-breaking dive to 3,028 feet will soon be reproduced on a postage stamp to be issued by Monaco. It will be one of seven stamps in a series called "Man Under the Sea," issued to publicize the Oceanographic Museum of Monaco.

The Bathysphere stamp, in a 1-franc denomination, bears the legend "New York Zoological Society."

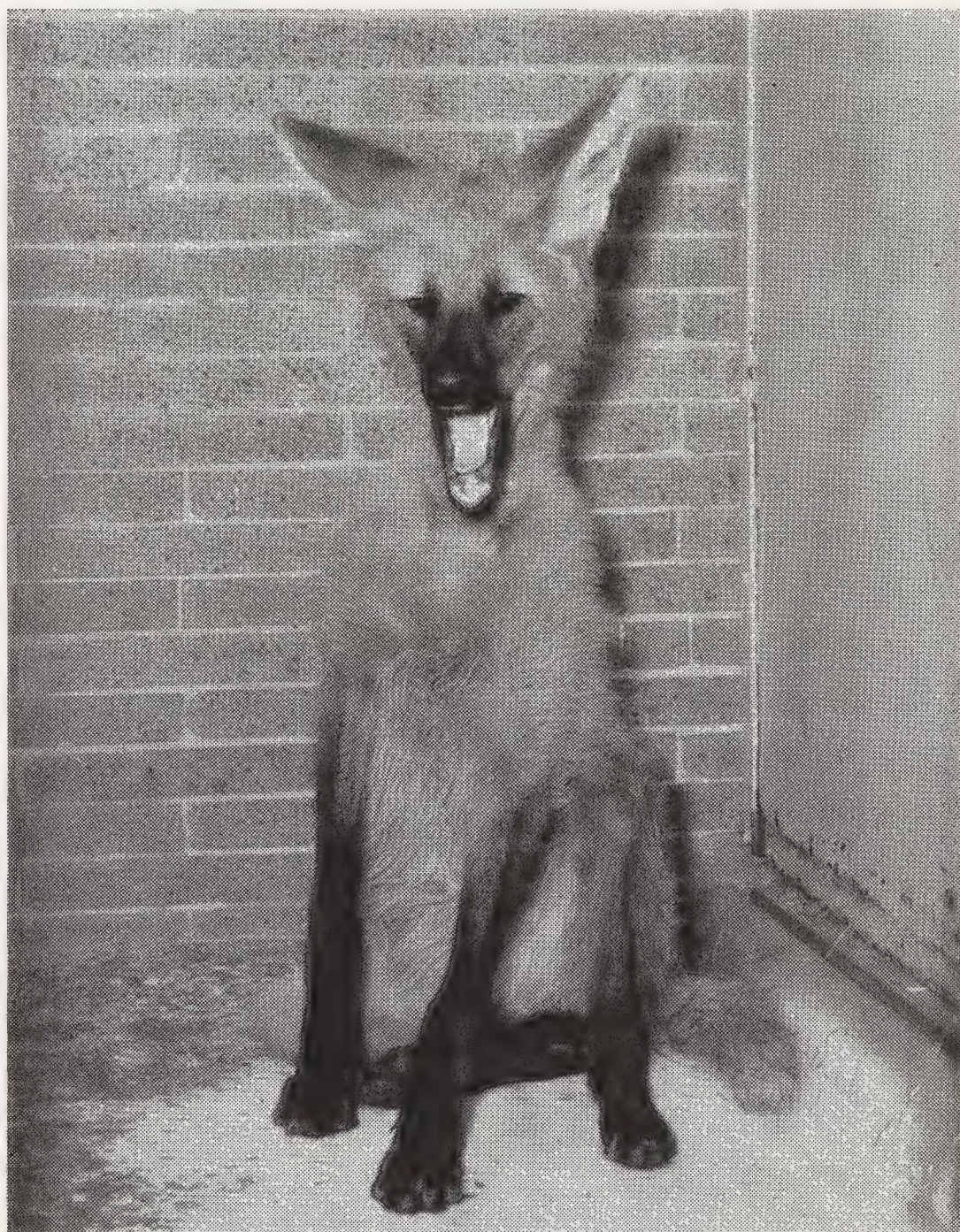
Reunited for Thanksgiving

In advance of the birth of a fourth offspring to Phoebe, the Nile Hippopotamus, on September 28, we barred Phoebe's mate, Peter the Sec-

ond, from the family's swimming pool in the Elephant House — knowing from experience that Phoebe would be savage and unsociable for several weeks thereafter. On November 20, more than seven weeks after the birth, Phoebe had calmed down sufficiently so that it was judged safe to allow Peter back in the pool. The baby was found to be a female, and eventually a name will be chosen for it from among hundreds suggested by children throughout the country, as a result of publicity by the "Discovery" television program.

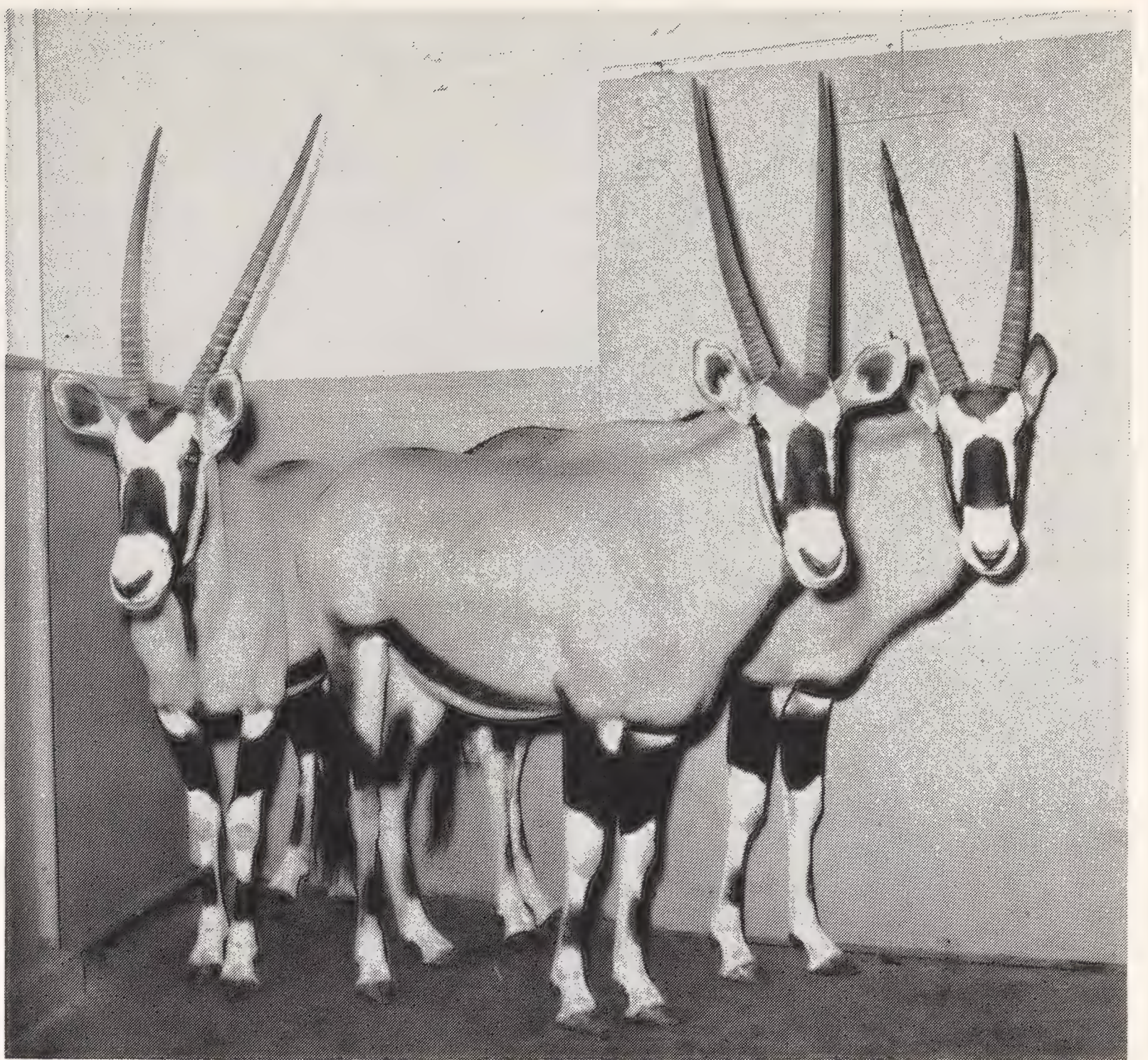
New Trees in Park

A program of tree-planting around Baird Court has been started, to replace eleven stately American Elms that have been killed by the Dutch elm



For the first time we are exhibiting the rare South American wild dog called the Maned Wolf — also aptly described as "a fox on stilts." Our pair lives in the Kangaroo House.

Three of the handsomest of African antelopes came in to the collection this fall — a male and two female Gemsboks, from the plains of south central Africa. Our only previous Gemsbok was on exhibition from 1930 to 1936. They are now in the Antelope House.



disease since the 1930s. Hundreds of other elms have died in the woods and presumably all the elms on the court will have to be replaced sooner or later. Pin Oaks and Honey Locusts, 5 inches in diameter and 15 feet tall, will be used, the oaks in gaps between the surviving elms and the Honey Locusts in wells on either side of the Sea Lion Pool.

We Get Birds of Paradise

Part of New Guinea, where Birds of Paradise come from, is in the process of being turned over to Indonesia and the political situation developing there will probably put an end to the collecting and export of Birds of Paradise for some time. We can regard ourselves as lucky, therefore, to have acquired four birds in good condition — a Red, a Magnificent, a Regal King and a Twelve-wired. The Regal King Bird of Paradise is particularly spectacular; it is on exhibition in the Jewel Room.

Those Persistent Monkeys

Many years ago the walls of the outside compartments of the Monkey House were painted with a lead-base paint — which experience taught us is poisonous to monkeys which pick off flakes

and eat them. Subsequently, time after time, the walls have been repainted with non-poisonous paint, and it would seem that under no circumstances could the animals reach the residue of the lead paint. They did, however; persistent picking at cracks and flaws allowed them to get down to the bare walls and remove — and eat — bits of the old paint. We have now sandblasted the walls and all painted surfaces, right down to the iron, and the new finish is a rubber-base, non-toxic chlorinated paint guaranteed safe for licking, picking and eating.

Greenhouse for Tortoises

One of the unused greenhouses at the Farm-in-the-Zoo has been renovated to provide large, warm and sunny winter quarters for our Giant Tortoises and other reptiles. The breeding season for Giant Tortoises (of the Galapagos and Aldabra) does not change when they are brought to these latitudes and, since this falls between October and January, the cramped winter quarters in most zoos have been thought responsible for much of the difficulty in propagating these rare reptiles. If the greenhouse is as satisfactory as we expect it to be, we will request the return of some of the Giant Tortoises we have loaned to

southern zoos, with an eye toward establishing a breeding colony. The greenhouse renovation thus becomes a preliminary step in the direction of a "Survival Center" for the propagation of endangered species.

IN BRIEF

"Dead As the Dodo." Many of the animals in a large zoological park are on the "endangered species" list, but the public — seeing them thriving in the zoo — does not realize their status in the wild. To call attention to them, we have posted large, printed, oval signs on bulletin boards all around the Zoo. Printed in white ink on a black background, there is a reproduction of the extinct Dodo and the text reads:

DEAD AS THE DODO

Once there were vast numbers of Dodo birds. "Civilized" man killed them all — not one remains alive. Hence the expression, "Dead as the Dodo."

Many other animals may be as dead as the Dodo unless we protect them. This red symbol calls attention to endangered species. Look for it around the Bronx Zoo. And think about what it means — the final emptiness of extinction.

The red symbol referred to is a small red circle and arrow, with "An Endangered Species" printed on it, that is attached to the species labels of animals in danger of extinction.

The Death of Ookie. Ookie, the Aquarium's celebrated 3½-years-old female Walrus, died on September 17. Since early in 1960 she had suffered from what appeared to be an infected tusk and a recurrence this fall — her third attack — did not yield to antibiotics.

Telling the Schools. There is, apparently, an unlimited demand for our school lecture services whereby a member of our Education Department visits New York City schools with a number of small and tame animals and talks about them. As the engagements run, about 50,000 children will be reached by the school lecturer this winter and we have already booked 230 requests for schools for next year.

Go Away, Gulls. Free-flying Herring Gulls are a perennial problem around the Zoological Park — they are adroit at stealing fish served to certain other birds — and we recently tried using a recording of a Herring Gull alarm cry to frighten

them away from the Wild Fowl Pond. Hearing it, the gulls became alert, prepared to take off, and then did fly away and disperse. They were followed by free-flying Mallards and Black Ducks. The recording will be used sparingly, so as not to wear off its shock value against the gulls.

PUBLICATIONS OF INTEREST

THE GOLDEN BOOK OF ZOO ANIMALS. By William Bridges. Illustrations, in color, by Scott Johnston. 64 pp. Golden Press, New York, 1962. \$2.99.

Forty-four stories of happenings in the Zoo, by the Bronx Zoo's Curator of Publications. Mr. Johnston's illustrations, every one in color, are imaginative, dramatic, amusing — themselves superb story-telling.

A TREASURY OF BIRDLORE. Edited by Joseph Wood Krutch & Paul S. Eriksson. 390 pp., 55 illus. Doubleday & Co., New York, 1962. \$7.50.

A delightfully readable anthology of articles about birds, mostly North American, by both old and modern naturalists, professional and amateur. The Zoological Society is represented by "Migration" by William Beebe and "Last of a Species" by William Bridges.

I WAS KISSED BY A SEAL AT THE ZOO. By Helen Palmer. Photographs by Lynn Fayman. Beginner Books: Random House, New York, 1962. \$2.95.

"Beginner Books" are intended to be read, by themselves, by small children. The photographs, illustrating the simple text, were made in the San Diego Zoo and show children in close contact with a great variety of animals.

THE BIOLOGY OF ART. By Desmond Morris. Many illustrations, black-and-white and color. 176 pp. Alfred A. Knopf, New York, 1962. \$6.50.

A serious study, by the Curator of Mammals of the London Zoo, of the scribbles, drawings and paintings made by apes and monkeys. The author believes that "Here, more vividly than anywhere else, it is possible to come face to face with the basic fundamentals of aesthetic creativity."

THE WORLD OF THE WHITE-TAILED DEER. By Leonard Lee Rue, III. 134 pp., 107 photographs. J. B. Lippincott Co., Philadelphia, 1962. \$4.95.

A loving study of a familiar animal, based on many years of observation and close contact in a rural area of New Jersey. The photographs, which tell practically the whole story of the white-tail, are exceptionally good.

A SENSE OF NATURE. By John Hay and Arline Strong. 128 pp., 128 photographs. Doubleday & Co., New York, 1962. \$4.95.

A happy blend of text (brief) and photographs (abundant) about a group of children exploring ponds and streams, sand dunes and bogs and thickets and the shore of Cape Cod. The unposed photographs catch — and to many children will transmit — the excitements and joys of the exploration.

THOREAU'S GUIDE TO CAPE COD. Edited by Alexander B. Adams. 32 photographs, 148 pp. Devin-Adair Co., New York, 1962. \$4.50.

An interesting new approach to Cape Cod by words and camera. Mr. Adams has chosen pungent passages from Thoreau's book and has illustrated them with his own excellent photographs. Anyone who loves "the Cape" should enjoy this book.

HIGH IN THE THIN COLD AIR. By Sir Edmund Hillary and Desmond Doig. 254 pp., 88 illus., many in color. Doubleday & Co., New York, 1962. \$6.95.

An account of the Himalayan Scientific and Mountaineering Expedition of 1960-61 which sought a conclusive answer to the question "Is there such a creature as the 'Abominable Snowman?'" and tested the ability of men to live for prolonged periods at high altitudes. "Yeti" skins turned out to be those of the Tibetan Blue Bear; the conclusion was that "... the myths and legends about the Yeti quickly move into the sphere of fantasy when carefully investigated."

BATS. By Glover Morrill Allen. Many illustrations, 368 pp. Dover Publications, New York. \$2.00.

A paperback reprint of a classic work first published in 1939.

THE LIFE STORY OF THE FISH. By Brian Curtis. xii + 284 pp., 6 plates, 34 figs. Dover Publications, New York. \$1.50.

When I reviewed this book in 1949, I declared that I believed it to be the best popular book in English ever written about fishes. Today, I am more convinced than ever that it is, and I still recommend it above all others. In fact, it was I who called the book to Dover's attention as a possible reprint. — J. W. Atz.

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The Society and Its Movies

From advance accounts, "Wild Gold" promises to be one of the best films ever shown to Members at a Society Annual Meeting. An original motion picture about the competition between Masai cattle and Kenya's wild animals, "Wild Gold" was photographed by Royal Little and Jim Simon (former Staff Associate and Walt Disney Cameraman) and produced with original script and music by Irving Jacoby. Robert Montgomery narrated it.

We predict "Wild Gold" will make history (natural history, that is) and take its place among other trail-blazing movies introduced by the Society. Since 1935, the Society has shown well over 100 movies to its Members at Annual Meetings, and we think you'll agree that the partial list of motion pictures that appears below is impressive.

1935-1940

Trailing The Seahorse (Sam Dunton). An early example of descriptive zoology which attained wide theatrical distribution.
The Evolution of Lizards into Birds (William Beebe). One of the first animated natural history films.

1941-1945

The Blind Fish of La Cueva Chica (Sam Dunton). These extraordinary fish are still under intensive study in 1962.
High Over The Borders (Irving Jacoby). One of the Society's most successful movies. National barriers exist for men, but they don't for birds.
The Life and Good Times of the Giant Pandas (John Tee-Van). An account of an expedition to China.

1946-1950

One Second in the Life of a Hummingbird (Henry M. Lester). Only ultra-slow motion could adequately unfold the mysteries of the hummingbird's flight.
Baby from Borneo and Andy's Animal Alphabet (Sam Dunton). Two lively movies calculated to beguile elementary school children across the nation.
The Living Forest (John Storer and the Conservation Foundation). The first of a dramatic series of films concentrating on conservation.

1950-1955

Paysages du Silence (Commandant Jacques-Yves Cousteau). For the first time, many Members were introduced to the wonders of the silent world by the great pioneer of underwater exploration.
The Locomotion of Snakes (Sam Dunton and James Oliver). The first of a definitive educational series on reptiles.

1956-1960

Adelie Penguins of the Antarctic (William Sladen). A brilliant and complete report of an expedition. The life cycle of Adelies was photographed for the first time.
Reproduction of the King Cobra (Sam Dunton and James Oliver). Another educational film on reptiles, showing hitherto unrecorded phases of the cobra life cycle.

1961-

The Mountain Gorilla (George B. Schaller). Dramatic, close-up motion pictures of this biggest and rarest of the Great Apes in its natural habitat.
Tomorrow (William Conway). A motion picture to explain concisely and articulately the Society's building program for the Zoo and Aquarium.

Yes, we think "Wild Gold" can join this distinguished company. But why not come to the Annual Meeting on January 10 and judge for yourself?



The Work of
The New York Zoological Society

in CONSERVATION

CH

Osborn
SOCIETY

One day a few months ago . . .



A REPORT ON THE
SCIENTIFIC WORK
OF THE NEW YORK
ZOOLOGICAL SOCIETY

On a certain day a few months ago a number of seemingly unrelated things were happening.

On a mountainside in Wyoming a woman watched a female elk "baby sitting" eight elk calves while their own mothers went off duty.

In a basement laboratory in Coney Island a man weighed a speck of white powder on a microbalance.

In a rainforest in Trinidad an East Indian boy searched for passion-flower vines.

In the Bronx a scalpel held in rubber-gloved hands made a last tiny slice and the fingers lifted a tumor from the breast of a bird.

On the other side of the world, in East Africa, a tired man worked in a tent at night, summarizing his field notes of the day.

* * *

These diverse activities had one thing in common — the New York Zoological Society was involved in them all. They are random selections from the complex pattern of research that the Society has inspired, or financed, or sponsored. Half a hundred other examples, just as heterogeneous, could have been chosen.

This brief report to Members of the Zoological Society can hardly do more than mention some of the obscure corners of the natural world into which our research people are trying to throw a little light. They aim in general at broadening the field of zoological knowledge, but surprisingly often "pure" research has an intimate alliance with human welfare.

* * *

The sea is the last great frontier on Earth, and the study of ocean life is inevitably becoming one of the most active fields in biology. We foresaw this. Four years ago we created a Department of Marine Bio-

chemistry and Ecology at the Aquarium and here Dr. Ross F. Nigrelli and his associates are exploring the chemical composition of marine animals and the substances they produce and release into the water around them. This is pioneer work, aimed at greater understanding and drawing larger values from the productivity of the sea, including promising new drugs for man's pharmacopeia. The group has already discovered Ectyonin, extracted from a sponge, a substance which shows antibiotic properties against a variety of harmful microorganisms, and Holothurin from a sea-cucumber — the first steroid saponin found in an animal instead of a plant. Holothurin has noteworthy effects on the development of sea-urchin eggs, on certain cancers in mice, and as a powerful blocking agent on nerves. We shall be hearing more about Ectyonin and Holothurin.*

As the Aquarium's Pathologist, Dr. Nigrelli guards the health of the Aquarium's exhibits. Long ago he became aware of the relation of liver disease in captive fishes to diet and other artificial environmental conditions — a study that has suddenly broadened to include the liver tumors of hatchery-raised rainbow trout, a matter of great concern to fish culturists in the United States. He is deep, too, in the investigation of tuberculosis in fishes. Who knows where these studies may lead?

Twenty-two years ago, by the accident of encouraging the late Dr. Myron Gordon to pursue his interest in fish genetics, the Society embarked on one of its most widely-acclaimed and fruitful investigations. In later years, indeed, it attracted substantial financial support from the National Cancer Institute because of what it revealed about the inheritance and development of cancer. In the Aquarium's Fish Genetics Laboratory Dr. Gordon bred generation after generation of tiny tropical fish, at last achieving an inbred strain of genetically identical fish — all as alike as identical twins. Then for the first time it was possible to successfully transplant fins, gonads and other organs — and also cancerous growths — from one fish to another. Dr. Klaus Kallman, who succeeded Dr. Gordon, developed the technique and is using it to analyze the migration of pigment cells and their transformation into melanoma (black cancer) cells.

How do Walruses and Seals regulate their body temperature? How fast does a Walrus grow? Why does a Whale swim ashore and die,

* As this report was going to press, we were notified that a grant of \$266,400 has been made to the Zoological Society by The John A. Hartford Foundation, Inc., for a three-year program of research in the biochemistry of marine organisms.

rejecting the sea? How do Belugas communicate with each other underwater? These are some of the questions Dr. Carleton Ray is puzzling over at the Aquarium and in Alaska.

Aquarium Director Christopher W. Coates and his associates at Johns Hopkins and Columbia University are pursuing, as they have done for more than twenty years, the biochemistry of the Electric Eel — a study that has told us much about the way human nerves function. Dr. James W. Atz is reviewing the enormous mass of writings on hermaphroditism and intersexuality in fishes.

* * *

The twelve hundred kinds of mammals, birds and reptiles that live in the Bronx Zoo are twelve hundred opportunities for research in diet, reproduction, physiology, behavior, pathology — in a dozen fields of natural history. Here are living organisms from deserts and seas, forests and plains, the tropics and the Arctic, all bringing their specialized ways of life, their specialized diets, their specialized diseases, too, and making them available for study. It is a fascinating research opportunity, and one that often makes the Zoological Park staff wish the day were 48 hours long.

There is no way of stretching the 24-hour day, but the same result can be obtained by enlisting the help of research people in other institutions and multiplying the number of minds concerned with specific problems. Cooperative projects generally involve supplying animal material — such as blood, parasites and tissues — to other scientists, or else in working with them on direct investigations in the Zoological Park. Some of these projects are of no practical importance to the Zoological Park, but are invaluable to comparative pathologists and anatomists, and are a scientific service we welcome. With responsibility for exhibition, preservation and breeding of such a large and varied collection resting on them, our scientific staff of three Curators and a Veterinarian can never put research first in their thinking. Nevertheless, the practicalities of successful animal exhibition and reproduction lead them to observations that broaden zoological knowledge.

As one example, our collection of Parakeets is infinitesimal compared to the number of these birds kept as pets in homes, yet tumors — some of them benign, some malignant — show up in our small collection, and it is reasonable to suppose that the proportion may be as high among the

thousands and thousands of Parakeets sold and kept in the metropolitan area. Several years ago Dr. Charles P. Gandal, our Veterinarian, let it be known that he would welcome the chance to examine and operate any tumorous Parakeets in the area. He has performed a great many successful operations since then, has made a motion picture in color demonstrating his techniques, and has begun to draw conclusions about the connection between diet and tumors in Parakeets. The study is not finished, and probably won't be for some time. Something's always getting in the way — for instance, the studies that resulted in technical papers on "Practical Technic for the Relief of Egg-bound Birds" or "Okapi Milk Analysis" or "The Use of Promazine and Meperidine as an Aid in Primate Surgery."

Right now Dr. Gandal is much concerned with working out the best methods of anesthetizing and tranquilizing birds, and in defining diagnostic tests for visceral gout in birds.

The exigencies of modern Zoo exhibition can lead into a lot of fascinating sidepaths, as Curator Joseph A. Davis, Jr., of the Mammal Department is finding. The "Red Light Room" he devised for the Small Mammal House, as a means of making nocturnal mammals active in the daytime, has led him into new experiments with reversal techniques, into studies of temperature selection and den building by small mammals. Out of them may come papers that will tell us how temperature preferences and ways of building a den are involved in animal relationships — and incidentally much about keeping small mammals on public exhibition.

When he was a leisurely Curator of Birds, before he became Director of the Zoological Park as well, William G. Conway had special little research projects tucked away in a dozen corners of the Zoo — a new type of incubator for the hatching of wild birds ticking away in one basement room in the Bird House, a weighing device set up elsewhere to collect data on the big birds of prey, Puffins being watched and photographed at regular intervals in still another building, leaf piles being set alight each fall to observe the behavior of Ostriches in the smoke and flames (they seem to love to roll in hot ashes!), diet variants being worked out for Flamingos. . . .

Mr. Conway has had to back off from some of those investigations since the direction of the entire Zoological Park has fallen on his shoulders, but not a single one of them has been dropped; they are simply not being pursued as intensely as before. In time, all of them will come to fruition.

When Dr. Herndon G. Dowling came to our Reptile Department three years ago, he brought with him a long-term research project involving the genetic relationships and systematics of the Ratsnakes. He brought the Ratsnakes, too — scores of them that taxed the cage resources of the Reptile House laboratory. Since the tendency is for an active Curator to start new research projects every time an operational exhibition problem comes up, Dr. Dowling is no longer just a “Ratsnake man.” Take Marine Iguanas. Nobody — and that includes the Bronx Zoo — has been able to keep them, for they seem to feed exclusively on sea weed. But is that the whole story? No real study of these monstrous lizards of the Galapagos Islands has ever been made — until Dr. Dowling went on an expedition to the Galapagos this spring. He is also working on the brooding habits of Pythons (two species obligingly nested in our Reptile House, in full view of the public) and in the “Maintenance in Captivity of Nocturnal Neotropical Snakes.” That discouragingly technical title hides a maddeningly elusive problem: how do you keep a tropical Bushmaster alive in the Zoo for years and years and years? Dr. Dowling *almost* knows the answer — it’s a matter of keeping the tropical snake cool enough! — but there could be a few variables he doesn’t know about. Research is continuing and one of these days, we are convinced, we are going to know a very great deal about the relation of temperature to eating habits and longevity in reptiles.

* * *

The reference to passion-flower vines at the beginning of this report may sound peculiar in an account of zoological research, but these vines interest us very much — for the caterpillars of heliconid butterflies feed on them. And currently, at our Department of Tropical Research Laboratory on a mountainside in Trinidad, we are deep in a study of the systematics of these butterflies.

That forest-girt laboratory exists solely for research. Working out of it, Jocelyn Crane has spent uncounted hours kneeling on mud-flats all over the world, observing and photographing Fiddler Crabs in preparation for a great monograph that will tell the story of their evolution — and illuminate certain general evolutionary principles at the same time.

As a resident naturalist at the laboratory for almost five years, David Snow has accumulated an enormous amount of data on the birds of Trinidad and is now back in Oxford preparing fourteen technical reports.

Their subject-matter gives an idea of the scope of his studies: the biology of the Black-and-White Manakin, a comparative study of the displays of certain manakins, the natural history of the Oilbird, the biology of the forest hummingbirds, the feeding ecology of tanagers and honeycreepers, the breeding biology of Trinidad swifts, the breeding seasons of Trinidad land birds, the time required for feeding by tropical forest birds, weights and measurements of Trinidad birds, fruiting periods of tropical trees in relation to bird ecology. You can accomplish a lot in five years.

A dozen other lines of research are being carried on at this moment or have reached the stage of being prepared for publication — prey detection in fish-eating bats, longevity and responses to drugs in moths, competition in flycatchers, the physiology of the inner ear in bats and other mammals, to name a few.

And the work goes on around the clock. At sundown in the Trinidad laboratory, somebody is sure to be rigging a nightlight to attract moths, or training binoculars on swooping bats, or creeping through the forest to capture nocturnal scorpion-spiders.

* * *

One generalization can be made about research on living animals: it is seldom sedentary. Take Dr. Margaret Altmann's brand of research, for example. For a number of years she has been studying the social behavior of Moose and Elk at the Jackson Hole Biological Research Station in Wyoming, which the New York Zoological Society founded in 1949. Such a study involves following the herds on horseback, camping in the mountains, taking the weather as it comes. Most recently Dr. Altmann has been observing how Moose and Elk and Bison handle the problem of their Senior Citizens — the aged individuals in the herds. Her studies are not completed, but when her technical reports are finished she has promised an article on "The Elders of the Herd" for our magazine, *Animal Kingdom*.

The Jackson Hole Biological Research Station operates only in summertime, for in winter the snow drifts roof-high. Each summer a dozen projects concerned with the biology of the area are in progress. Some are sponsored by the Zoological Society, some by the University of Wyoming (which operates the Station in association with the Society), others by various research foundations and funds. It is the only field research station of its kind in the West.

Enough books to stock a sizeable library have been written about the animals of Africa and still we need to know more; we *must* know more if we are to save enough animals for future generations to see or even to write books about. For old Africa is on the move, old values are being replaced and new conflicts between man and animals are developing. To pinpoint present and potential conflicts and avert them if possible demands *exact* knowledge of what certain animals do, what they eat, how far and how fast they migrate, whose sovereignty and whose economic interests they affect.

We know plenty about hunting the Wildebeest and other plains animals in, say, Kenya and Tanganyika. . . .

What do we know, in unarguable statistics, about their migrations and food habits?

Thanks to information gained from various sources, especially two years of work by Dr. Lee M. Talbot, we *now* know a good deal. Dr. Talbot's project, like all such, was carried out under arduous conditions in the field. The result will be a detailed report that will help in making decisions concerning wildlife protection as they arise. Support of his work has been one of the most worthwhile uses of funds from the Zoological Society's sources.

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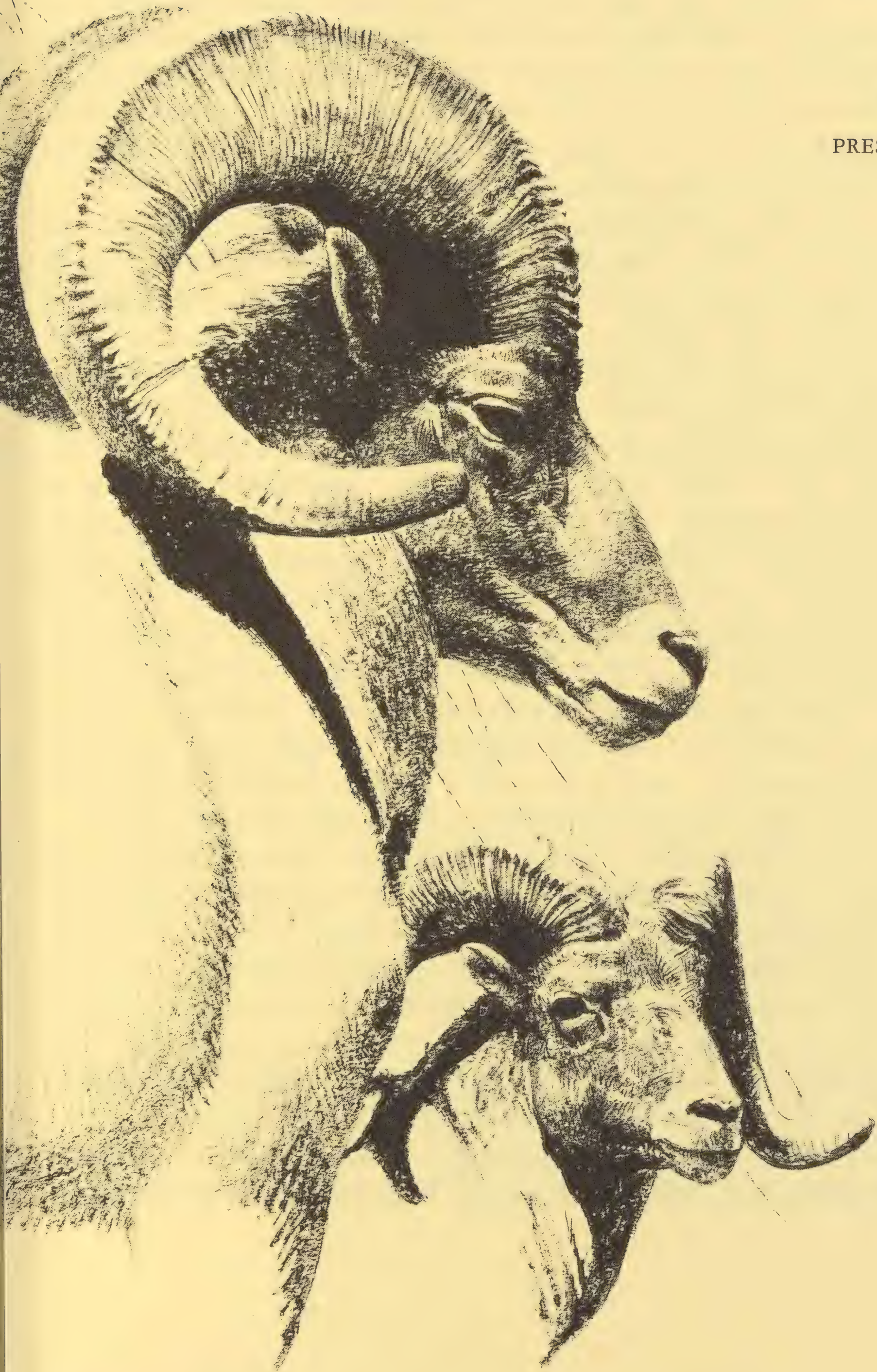
There is so much to be done! So much to learn and to pass on! This report outlines a few of the things the New York Zoological Society is doing and learning and passing on. It seems to us that they prove abundantly that man and animals are inextricably allied in this natural world.

FAIRFIELD OSBORN

*President of the
New York Zoological Society*

The Work of
The New York Zoological Society
in CONSERVATION
and SCIENTIFIC RESEARCH

By Fairfield Osborn
PRESIDENT OF THE SOCIETY





THE WORK of the New York Zoological Society is generally associated with the management of the New York Zoological Park (Bronx Zoo) and the New York Aquarium and there is far less awareness of the Society's activities in wildlife protection and scientific research. This is understandable because the Zoo and the Aquarium, attracting some three million visitors a year, are so well known and so widely publicized. However, throughout the Society's history conservation and research have been an essential part of its purpose.

The first accomplishment of the Society in wildlife protection was made more than a half-century ago when it played a leading role in saving the Bison from extinction in our own country, through the creation of the American Bison Society and the formulation of a program for the restoration of this animal. At that time the number of Bison in the wild state had dwindled from an original population estimated at fifty million animals to only a few hundred. Success met this effort. Today there are more than nine thousand Buffalo in National Parks and other reserves, and the future of this great mammal, so symbolic of the early pioneering days, is reasonably assured. Another action at that time was the vigorous and successful work, in concert with the Audubon Society and other groups, to establish legislation that prohibited the use of the plumage of wild birds in the millinery trade.

Those early years, too, witnessed the initiation of scientific work by staff members and associated zoologists. The publication, *Zoologica*, was founded in 1907, to serve as a medium for recording scientific studies undertaken or sponsored by the Society. Its first volume contained such technical papers as: "Geographic variation in birds with especial reference to the effects of humidity" and "The ecology of the adult hoatzin," by William Beebe, then Curator of Birds at the Zoological Park; "The northern elephant seal *Macrorhinus angustirostris*" and "The porpoise in captivity," by Dr. Charles H. Townsend, Director of the New York Aquarium (which had been under the Society's management since 1902); "The feeding habits of serpents," by Raymond Ditmars, Curator of Reptiles at the Zoological Park. Since its first issue, 47 volumes of *Zoologica*, containing 712 papers, have been published, recording the scientific work of the Society's staff of the Zoological

Park, the Aquarium and the Tropical Research Department, together with that of other zoologists and biologists whose studies fall within the Society's interests.

These studies represent contributions to the advancement of zoological knowledge in a wide spectrum, including physiology, genetics, behavior, systematics, pathology, anatomy, evolution and ecology.

So much for tradition and past history. Time has wrought its changes in the objectives of both wildlife protection and scientific inquiry.

As regards the former, the crisis so gravely threatening the animals of our own continent has been greatly lessened due to the extraordinary advances of the conservation movement throughout the United States and Canada. In its place a similar crisis—in many respects an even more acute one—threatens the wild animals of Africa and of numerous Asiatic regions. Today, therefore, the Society's efforts are being mainly concentrated overseas where the need is now so great.

In scientific work also, changes have come about. Earlier observations and theories have sometimes been proved untenable because of the advancement of zoological knowledge. Further, work which previously concentrated so largely on classification of animals and anatomy per se has moved towards wider horizons where animal behavior, the influences of environment, genetics and biochemical processes are all involved.

The Society's activities in conservation and research may best be illustrated by reference to the work of recent years. It will be noted that in a number of instances projects in wildlife protection as such are directly augmented by knowledge gained through field research. Obvious examples of this are Mr. Lee M. Talbot's two-year study of the ecology of the plains animals of Tanganyika and Kenya, and the study of the Mountain Gorilla in the Congo conducted by Dr. John Emlen as Principal Investigator, and Mr. George Schaller as Field Naturalist.

While the Society is concentrating most of its present efforts towards relieving the crisis threatening the animals of Africa, problems in our own country are not being neglected.

In 1954 we were approached by the noted naturalist Olaus Murie, who stressed the need for the establishment of a large wildlife reserve in the Brooks Range in northern Alaska. The Society, together with its affiliate, The Conservation Foundation, financed and sponsored a survey by Dr. Murie, which ultimately played an influential part in the establishment of the Arctic Wildlife Range through action of the Federal government.

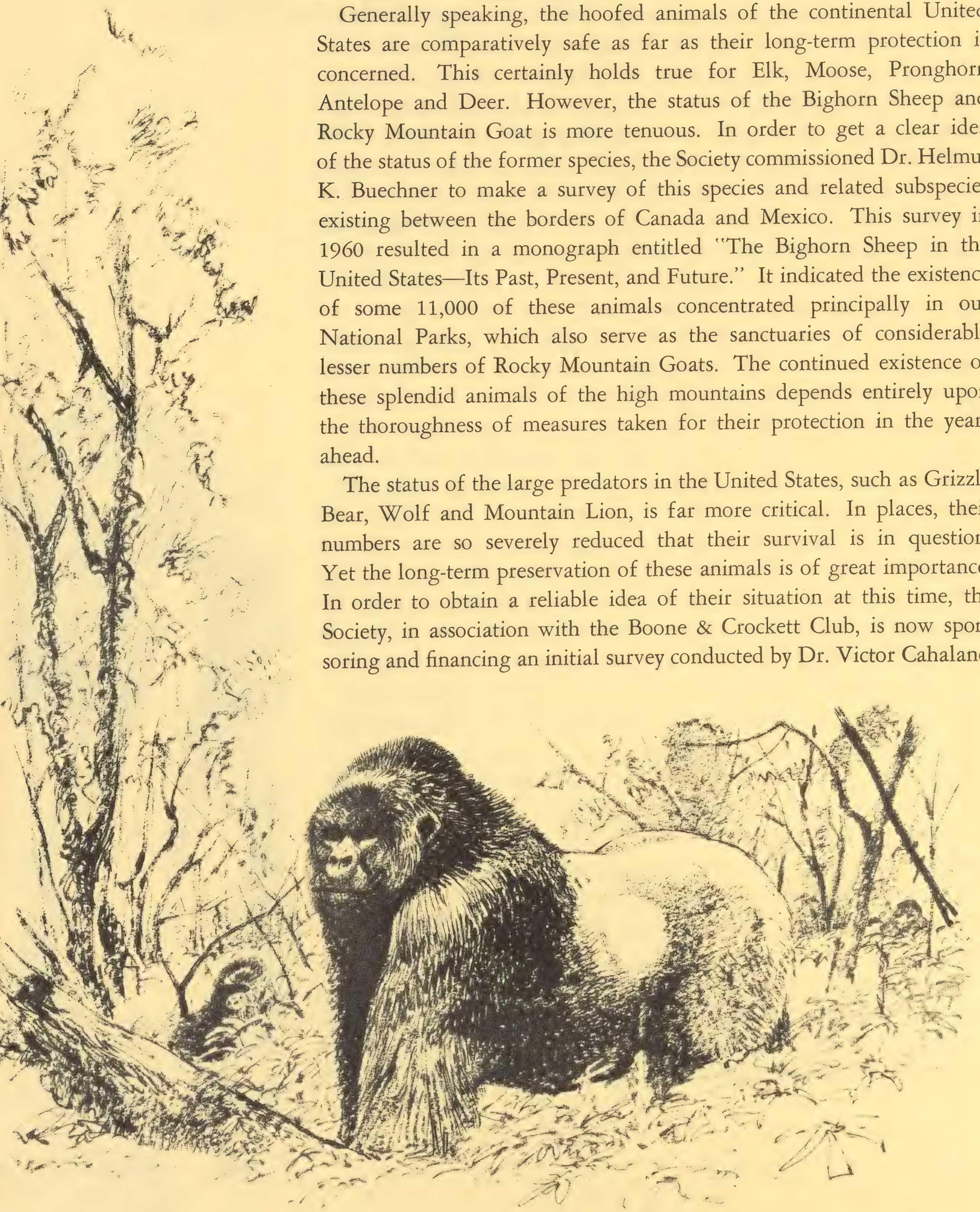
At that time, also, the Society founded and for some years financed and administered the Biological Research Station in Jackson Hole, Wyoming. Somewhat earlier the Jackson Hole Wildlife Park was established as a center to encourage public realization of the need for



preserving animals of this area. Subsequently, the administration of these two centers was turned over to the University of Wyoming and the National Parks Service, respectively, with the Society continuing to appropriate grants-in-aid for research work to the former institution. This Biological Research Station is the only one of its kind in the entire Rocky Mountain region.

Generally speaking, the hoofed animals of the continental United States are comparatively safe as far as their long-term protection is concerned. This certainly holds true for Elk, Moose, Pronghorn Antelope and Deer. However, the status of the Bighorn Sheep and Rocky Mountain Goat is more tenuous. In order to get a clear idea of the status of the former species, the Society commissioned Dr. Helmut K. Buechner to make a survey of this species and related subspecies existing between the borders of Canada and Mexico. This survey in 1960 resulted in a monograph entitled "The Bighorn Sheep in the United States—Its Past, Present, and Future." It indicated the existence of some 11,000 of these animals concentrated principally in our National Parks, which also serve as the sanctuaries of considerably lesser numbers of Rocky Mountain Goats. The continued existence of these splendid animals of the high mountains depends entirely upon the thoroughness of measures taken for their protection in the years ahead.

The status of the large predators in the United States, such as Grizzly Bear, Wolf and Mountain Lion, is far more critical. In places, their numbers are so severely reduced that their survival is in question. Yet the long-term preservation of these animals is of great importance. In order to obtain a reliable idea of their situation at this time, the Society, in association with the Boone & Crockett Club, is now sponsoring and financing an initial survey conducted by Dr. Victor Cahalane,



a mammalogist of wide experience. This report will be completed early in 1963 and it is expected that its findings will reveal specific opportunities for further effort in protecting these carnivores that are so valuable a part of the fauna of our country.

Profound and rapid changes—both political and physical—taking place in Africa constitute a threat of the greatest magnitude to the unique animal life of that continent. As indicated above, the Society decided a few years ago to concentrate most of its wildlife protection over there. The African Wildlife Fund was established in 1959 in order to attract contributions for this specific purpose. This Fund, supplemented by appropriations from the Permanent Wild Life Fund, of which the Society is Trustee, has to date expended more than \$150,000. Most of this money has gone towards conservation programs in Kenya, Tanganyika and Uganda. These expenditures have been made for a number of purposes, including field research that has ranged from studies of the ecology of plains animals in East Africa to that of the Mountain Gorilla in the Congo; installations of additional water sources for wildlife in selected areas; aircraft to control poaching; training of Africans in wildlife management; educational films, with commentary in the Swahili language, for distribution to adults and in school systems in Tanganyika and Kenya; and, finally, support of conservation organizations in Africa such as the East Africa Wildlife Society. This year a project of a novel kind has been undertaken and completed in the form of a Report to the Government of Tanganyika, stressing the economic values of wildlife in revenues to be derived from tourism. This report, of a cost of approximately \$20,000, was prepared by Arthur D. Little, Inc., subsequent to a special mission to East Africa that included a representative of this firm, representatives of the U. S. Park Service, Dr. Starker Leopold of the University of California, and one of our members, Mr. Royal Little.

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BEFORE PROCEEDING to a résumé of the Society's scientific work it should be recalled that as long ago as 1944, the following statement was made regarding the Society's work in conservation:

"Points of view should and do change with the passing of time. Our thinking regarding the activities of the Society in the field of conservation is gaining a new perspective. It is becoming more and more apparent that if the present rate of injury to the forests, soils, and streams of this country and in other parts of the world continues, the extinction of many lingering populations of wildlife is inevitable.

"It is time that the Society's future work in the field of conservation be extended, due to the serious threat to these natural



resources in this country and in other parts of the world. These living resources are the basis for the protection not only of wild animal life but of man himself. The Society intends, therefore, to give its active aid toward a better public understanding of these matters."

As a result, the Society sponsored and established an affiliated organization, The Conservation Foundation, in order to carry out programs of research and education concerned with the "living environment"—forests, soils and streams—which so evidently, among other values, are of such large influence in the perpetuation of animal life. Through the intervening years, this organization has joined with the Society in a number of projects concerned with wildlife protection.

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THE SCIENTIFIC WORK of the Society falls into two categories—research in the field and research in the laboratory and collections. The principal field station is that of the Tropical Research Department on the island of Trinidad in the West Indies, whose present work is devoted in the main to studies of evolutionary processes and the behavioral patterns of various forms of animal life. This Station is equipped with the laboratory facilities needed for its research. In addition to work at Trinidad, the Society has in recent years sponsored or given financial assistance to a series of field studies both in this country and abroad. Notable among these are: Bighorn Sheep in the United States, by Dr. Helmut Buechner; the ecology of Prairie Dogs of the Great Plains, by Dr. Carl B. Koford; the status and ecology of the Bighorn Sheep and Pronghorn Antelope in Northern Mexico, by Dr. Starker Leopold (publication costs); Mountain Gorilla in the Congo, by Dr. John T. Emlen and Mr. George Schaller; the Lemming in Norway, by Dr. Olavi Kalela; Wildebeest and associated plains animals in East Africa, by Mr. Lee M. Talbot; Manatee in the northeastern estuaries of South America, by Dr. Colin Bertram; and the forthcoming two-year study of the Elephant in Uganda, by Dr. Irvén Buss. Grants have been made to a limited number of sister-organizations whose scientific interests are related to those of the Society, such as the Jackson Hole Biological Laboratory, the Canal Zone Biological Laboratory and the Pacific Science Board.

An indication of the values of these field studies and others like them sponsored by the Society is reflected in the fact that supporting grants in an aggregate amount of \$411,000 have been received during the last five years from governmental and other sources.

It will be noted that a number of these projects are directed towards the gathering of basic knowledge concerning species of animals whose long-term survival is questionable. In these cases the information gained

is of high value in the preparation of practical and effective conservation programs.

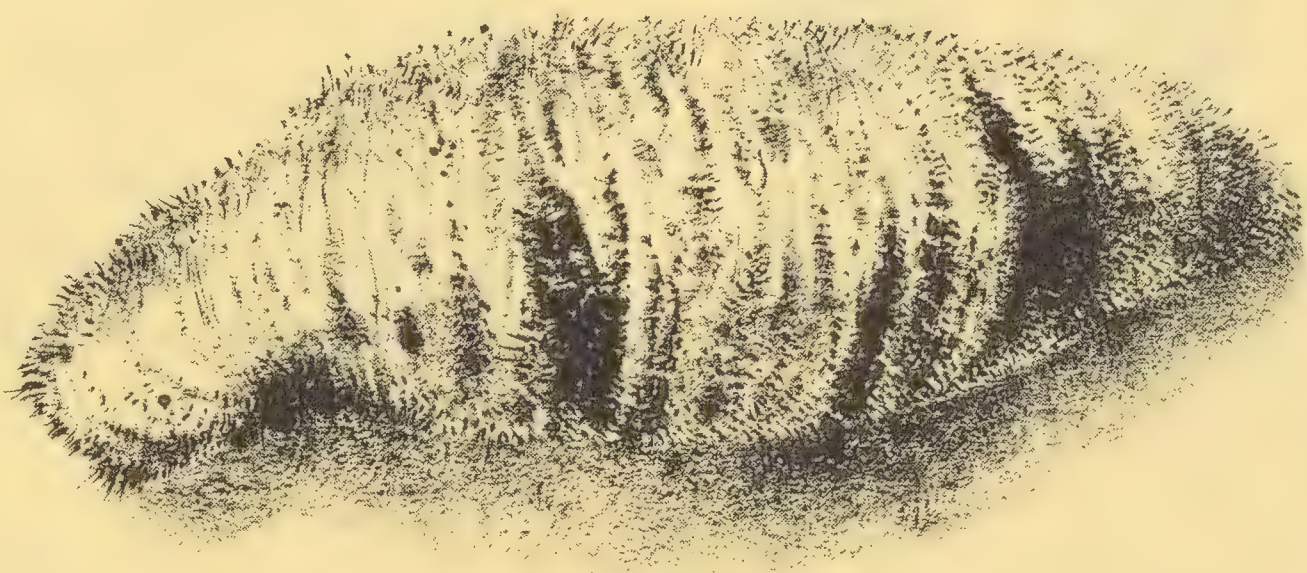
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THE SCIENTIFIC WORK of the Society centered in laboratories has witnessed a remarkable growth in recent years, notably in the fields of marine biology and biochemistry, to which special reference will be made below.

The hospital laboratory at the Zoological Park deals with problems of pathology of wild animals which, in many instances, throw light on pathological conditions common to human beings. A number of diseases, as might be expected, are shared by wild animals and people. Every animal that dies at the Zoological Park is given a thorough post-mortem in order to determine the cause of death. These findings are carefully recorded and represent an accumulation of valuable pathological information useful to hospitals and medical centers. Within the present year material has been provided to fifteen other institutions, and active collaborative work on specific problems is presently going on with a number of research centers, including those at Cornell University Veterinary College, Albert Einstein College of Medicine, Brandeis University, Rockefeller Institute, University of Puget Sound and Rutgers University.

At the Hospital in the Zoological Park, a continuing program of clinical research is in progress. Notable advances have been made in several fields, especially that of avian anesthesiology. The development of safe, effective anesthetic techniques has led to increased success in surgical procedures on birds of all sizes. A motion picture illustrating our anesthetic and surgical procedures has been shown at numerous veterinary meetings throughout the country.

The most notable current developments are those related to the extraordinary potentialities for further research in marine biology and biochemistry. The Society is determined to take the utmost advantage of the opportunities that exist for accelerated scientific work in these fields. In 1957 it established a new department, the Department of Marine Biochemistry and Ecology, which has led to the formulation of a plan for the construction of a Marine Biological Laboratory adjacent to the Aquarium. The National Institutes of Health has approved a grant by the United States Public Health Service of \$623,500 for the



construction of the laboratory and the Society is raising funds to match the federal grant; \$310,000 is now in hand.

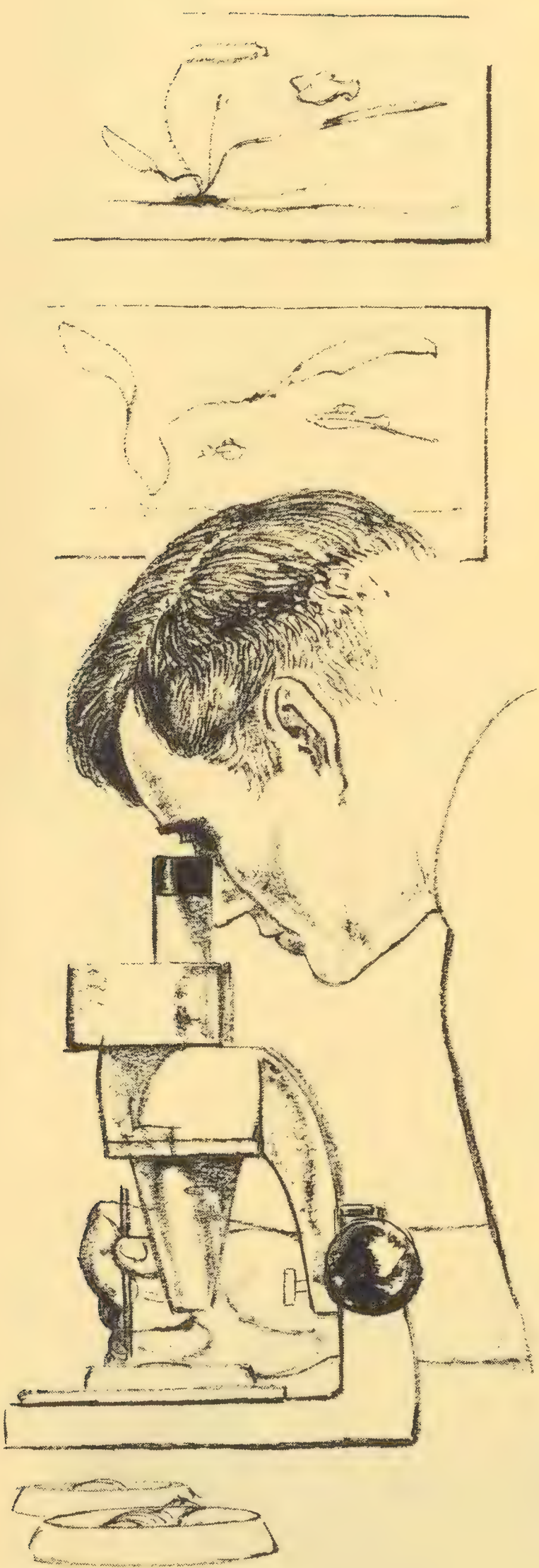
Meanwhile, the Department of Marine Biochemistry and Ecology, with at present only limited laboratory facilities at the Aquarium, is developing a series of new research programs. These are meeting with support from the Office of Naval Research, the Damon Runyon Memorial Fund and other sources and have recently been greatly assisted by a grant of \$266,400 from the John A. Hartford Foundation for studies on pharmacologically active compounds derived from marine organisms.

The New York Aquarium has long been involved in studies dealing with comparative pathology. The Laboratory of Fish Genetics, the only one of its kind, has been maintained by the Zoological Society since 1939. This laboratory, with its unique strain of highly inbred and specially selected fishes, has made outstanding contributions to the study of the inheritance and development of the melanoma, a highly malignant form of cancer. This laboratory, through the courtesy of the American Museum of Natural History, is presently located at the Museum. It is hoped that it may be moved to the proposed Marine Biological Laboratory upon its completion. Its research has been receiving support from the National Science Foundation, the National Cancer Institute, the Damon Runyon Fund and other agencies.

On November 4 the *New York Times* published an article by Dr. Howard A. Rusk, Director of the Institute of Physical Medicine and Rehabilitation of New York University-Bellevue Medical Center, entitled, "Therapy from the Sea, Biochemical Research at Aquarium May Explain Illnesses of Mankind." In this article Dr. Rusk wrote that "the New York Aquarium has made greater use of its facilities for research than any other public Aquarium," and, endorsing the plan for the new Marine Biological Laboratory, further stated that "the New York Aquarium is in a unique position to conduct research with its large and costly physical plant, its collection of aquatic animals and plants from various parts of the world, its specialized knowledge and its unlimited supply of pure sea water."

* * * * *

These activities—whether concerned with the protection of animal life or with the advancement of knowledge through scientific research—represent purposes to which the New York Zoological Society has been dedicated throughout its history. Presently, work in these two fields, often related one to another, is going forward at a higher tempo than ever before, principally because the need is greater. There are no limits to future accomplishments, assuming they receive the support required to make them possible.







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